360Rack
BY SOLAR360

INSTALLATION MANUAL
Metal, Tiled and Tilt Systems

360Rack_InstallationManual_Ver4.0_August 12 / 2013

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1. INTRODUCTION

The 360Rack Solar PV mount system was designed with the following key objectives;

a. Make it amongst the quickest systems to install on the market,
b. Minimise assembly work by the installer,
c. Offer features compliant with the latest standards,
d. Low cost,
e. Provide System support and design capability.

Pre-assembly of parts and “in-box” solutions, as well as, offering a completely integrated earthing system facilitates ease of installation. Flexibility is designed into each component allowing for a range of panel thickness to be accommodated and full adjustability without the use of packers on Tile Brackets.

The Tilt system offers quick and easy installation without setting angles and is designed to sit on top of the roof ridges.

The Anodised Aluminium rail has been designed to accommodate the smallest possible area without compromising on strength, it incorporates features such as integrated cable management to promote compliance to the latest AS-5033 requirements.

The system is compliant with the AS/NZS1170.2:2011 standard for wind actions including the proposed 2012 amendments. Further assurance is offered through a 10-year product warranty.

2. TECHNICAL SPECIFICATIONS

Roof Pitches:	Pitched roofs - 15-50 Degrees, Flat Roofs 0-10 Degrees
Roof Cladding:	All types (Except Longline)
Wind Regions:	A, B and C
Building height:	Upto 10 Mtrs
PV Module heights:	31-50 mm
Extrusions:	6063 T5
Fixings:	Stainless Steel on system and Galvanised Roof Screws
Tile Mount:	Stainless Steel
Standards:	BCA, AS1170.2, AS5033-2012, AS1664, AS4100, AS3566, AS1866
Warranty:	10 Years (According to BCA requirements)

3. SAFETY AND GENERAL PRECAUTIONS

This document's primary focus is the description of installation for the 360Rack mounting system. It is not intended to discuss safety hazards in detail as it is expected that all businesses have their own Safety Hazard documents as part of workplace legislation.

Where care or attention is required the following symbols will be used throughout the document;

Indicates a potentially hazardous situation that could result in death or serious injury.

Indicates a potentially hazardous situation that may result in minor or moderate injury.

Indicates a very important procedure that may cause delays in installation if not careful

Wind actions

Although detailed guidelines are provided at the back of this manual regarding design constraints and how to install to ensure compliance with the certification, it is important to realise that all installation possibilities are not covered by the certification.

Solar360 realise that it is important in some instances to provide individual certification. By the use of a standard marketing material, an installer can input individual project variables, which result in an output of recommendations to ensure compliance to the AS1170.2 standard. The output can then be sent to a designated structural engineer (that has pre-approved the calculations in the spreadsheet) for certification.

An installer must take into account that the mounting system is certified but the roof itself may not be compliant or it is in a state of disrepair.

Fasteners are supplied with the mounting system and if alternative fasteners are used, the installer should consult with the certified drawings at the back of this manual.

Modification of the mounting system outside of the installation guidelines including drilling of holes, deformation and use of inappropriate fixings may make installation un-safe/non-compliant and void the warranty.

4. INSTALLATION TOOLS REQUIRED

Name	Description	Notes	Picture
Impact Driver or Clutch Drill	Used for tightening all mount system M8 Lock Nuts and Roofing Screws	M8 Locknuts - Minimum Torque 15Nm – N.B Use Lowest speed only to avoid galling. (Thread welding)	
13mm Socket Bit or Ratchet spanner	Used for Tightening all mount system M8 Lock Nuts	M8 Locknuts - Minimum Torque 15Nm	
10mm Magnetic Hex driver Bit	Used for all Tighten all roof screws	Use impact Driver for fast and easy installation without drilling.	
For Tilt Install only: T-Bar 6mm allen key	Used to hold screw while tightening M8 nut.		
For Tiled Install only: Cordless Angle grinder with ceramic or diamond coated disc.	To cut small groove for Tile Bracket arm allowing tile to sit flush.		

5. MAIN SYSTEM COMPONENTS

AD-001 & 2

- Universal preassemled mid clamp.
- Fully adjustable in infinite increments.
- Ease of assembly: spring loaded to remain upright.
- Integrated earthing.

AD-003

- Preassembled.
- Slot for height adjustment.
- Pre-adhered rubber isolator.
- Optional leveller available to ensure vertical alignment.

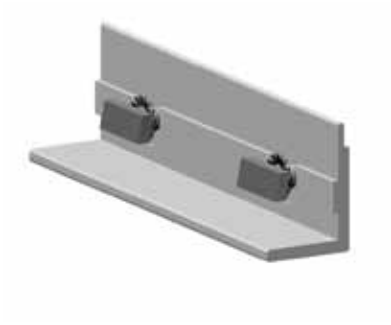
5. MAIN SYSTEM COMPONENTS

AD-004

- Universal end clamp.
- Adjustable in finite increments of 31, 35, 40, 45 and 50mm.
- Preassembled with T-Bolt, washer and Lock Nut.

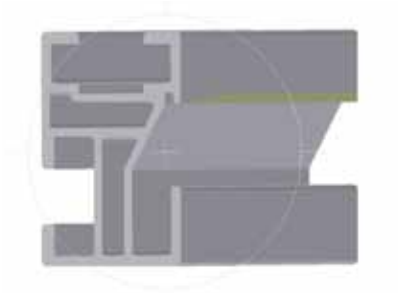
AD-005

- Preassembled.
- Height and sideways adjustability.
- Height adjustment to cater for tile heights of 30-50mm. (No need for packers).
- Stainless steel Arm ensures compliance to Wind Region C conditions.



AD-012

- Preassembly and ease of use allows for rapid joining of rails.
- Clear and neat joins that do not compromise rail strenght.
- Integrated earthing.



MR-3380 OR MR-2080

- Rail Height minimised to save on cost, weight and freight.
- Integrated cable tray system with Aluminium Cable clamps. AS5033 compliant.
- Rail lengths of 2080mm allows for 4 panel configurations, ease of lifting.
- Anodised.

AS-014

- A kit comprising 4 preassembled Tilt frames, rail clamps and fastener components to mount 4 panels.
- Panel mount assemblies and rails are to be ordered separately.
- The preassembly of each Tilt frame and ease of Tilt adjustment means that this system is one of the quickest on the market to install.
- On a 5 degree pitch, inclinations of between 15 and 30 degrees are achievable in approximately 5 degree increments.

6. INSTALLATION

All installations must be performed in accordance with Clean Energy Council (CEC) Design and Installation guidelines. In this respect, the site planning, preparation, positioning and orientaion of the PV system must follow these guidelines. Where there is any conflict between this document and the provisions of the CEC guidelines, the later shall take precedence.

It follows that the instructions below only considers the actual Installation methodology associatted with the 360Rack system.

6.1 Preparation

After considering layout and planning job, consult with wind design data at back of this document to ascertain the correct number of mounts required for the rail length being used.

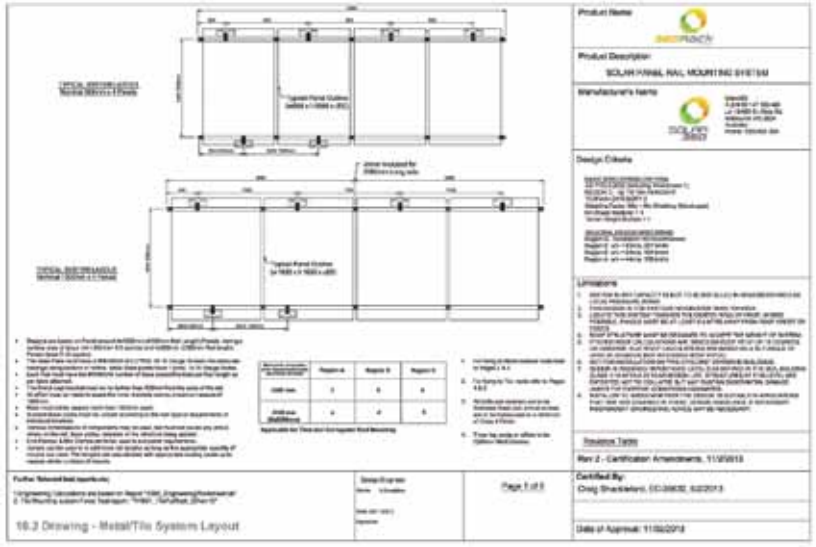


Figure 1: Typical Wind Design drawing

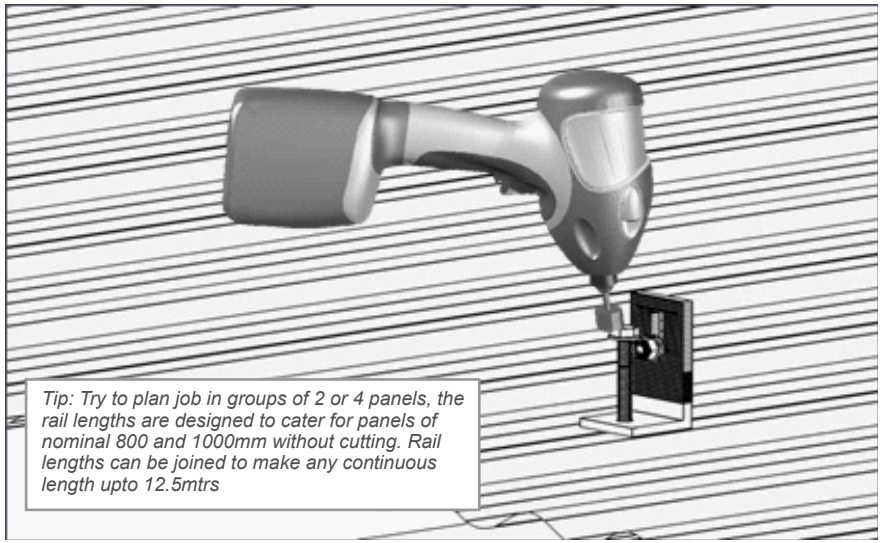

Tip: Try to plan job in groups of 2 or 4 panels, the rail lengths are designed to cater for panels of nominal 800 and 1000mm without cutting. Rail lengths can be joined to make any continuous length upto 12.5mtrs

Figure 2: Drive screws into batten

6.2 Metal Mount Brackets

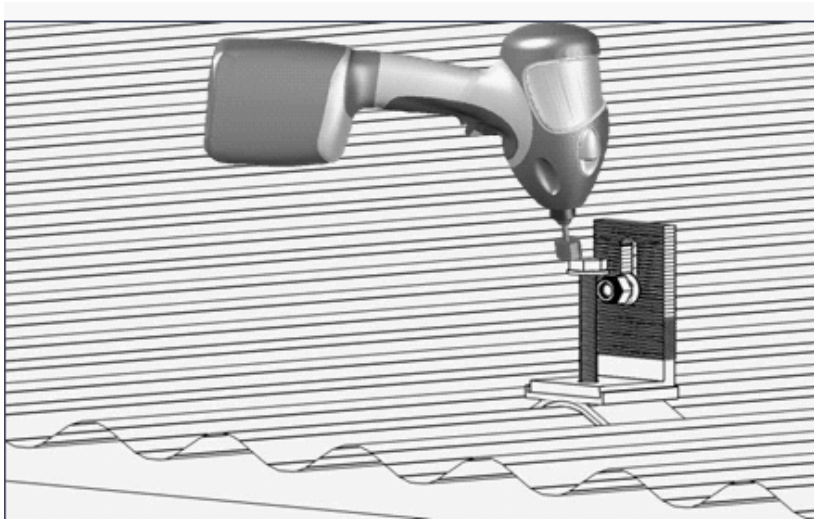
Install Brackets with Galvanised 17-10x65 Screw provided driven into batten (In some cases Truss or rafter).

Tip: An impact driver that requires no pre-drilling best performs this function.

Tip: For roofs with exposed fixings, determine where the roof mounts will be positioned based on position of existing roof screws.

Tip: For a steel roof with hidden fixings, determine where the battens are by using a stud finder or by "feel" i.e. standing along the valley section of the roofing material until firmness is felt. This point can be marked and the procedure repeated until a straight line of markings is determined.

Tip: Do not remove existing roof screws. Instead, install on unused crest. In order to avoid slippage of the screw point it is prudent to indent roof sheet with point of screw by giving a tap with a hammer to top of screw head.



Tip: Fix the bracket in place with the upright section facing towards the ridge of the roof.

Tip: The bracket comes preassembled with T-Nut and rubber base seal. No other washer or seal is required.

Tip: For corrugated systems and particularly fussy customer (or installer), an optional component can be purchased to ensure that the L-foot sits perfectly square to the roof surface. (See Diagram below)

Figure 3: Use of corrugated roof leveller

6.3 Installing Tile Brackets

Install Brackets with Galvanised 17-10x40 Screw provided driven into Truss or rafter (not battens).

Expose the timber rafters by sliding or removing tiles at the required spacing and at multiple points determined by the required amount of brackets.

The tile bracket arrives pre-assembled with fasteners loosely and ready for assembly/adjusting.

Move the tile arm so that it loosely aligns with the “Valley” of the tile. The screws can then be driven into the base plate ensuring that screws are placed on timber rafter approximately 10mm in from edge of timber and driven on a inward angle.

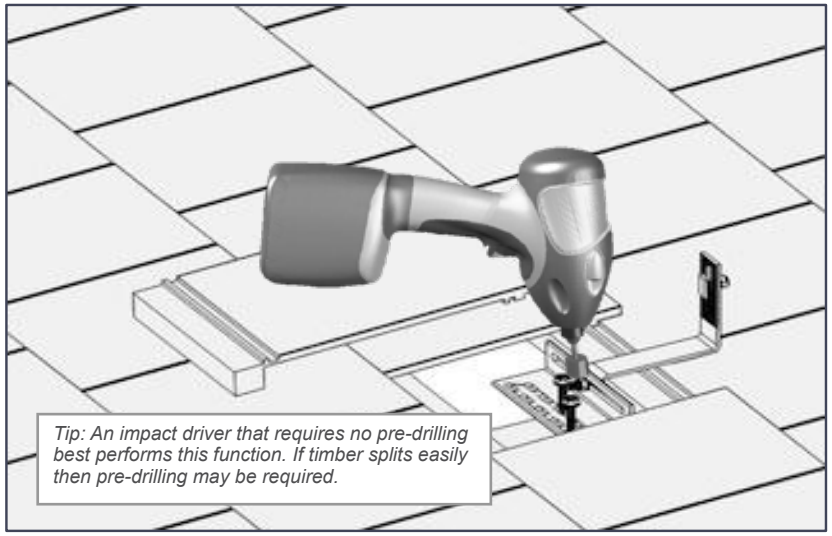

Tip: An impact driver that requires no pre-drilling best performs this function. If timber splits easily then pre-drilling may be required.

Figure 4: Align Arm with valley of tile and tighten Screws

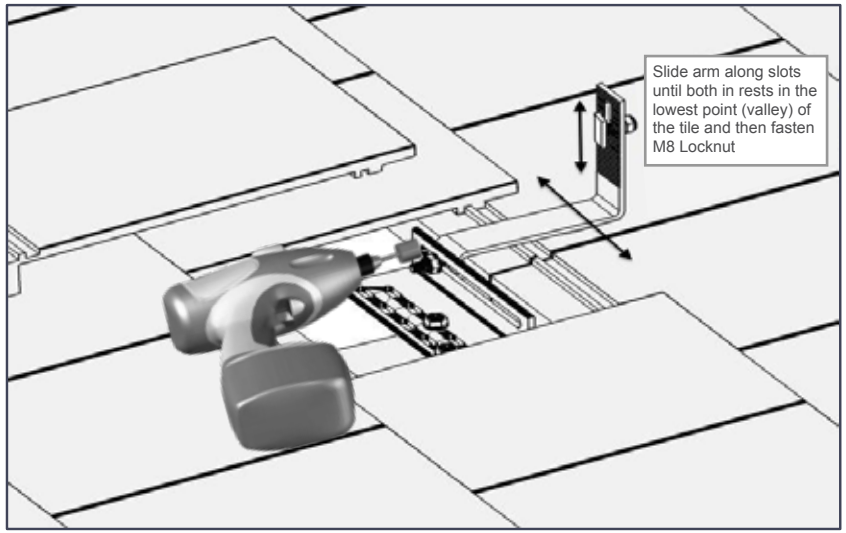
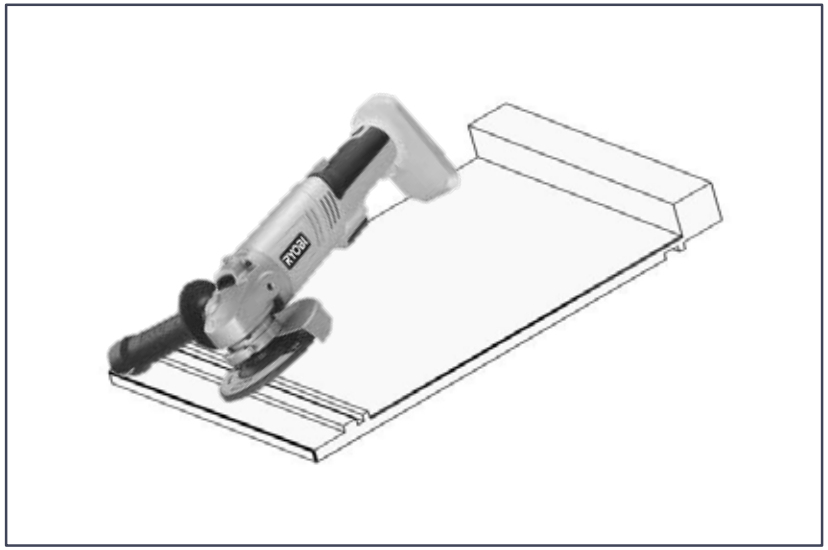


Figure 5: Adjust arm with valley and height of tile and tighten Locknut

Move the adjustable Tile Bracket arm Left-Right up-down to unsure perfect placement on the valley of the tile and perfect height allowing for the thickness of the tile without the use of packers.

Once the Tile bracket has been fixed and set in place, the tile can be replaced. If the tile sits too high over the top of the bracket, a section of tile can be removed to accommodate the thickness of the bracket.



Installer should wear suitable ear and eye protection when using a grinder.

General Note for Fixing into Steel Purlins

For steel roof Purlins, M6 Zip screws should be used, if material thickness is less than 1mm than consider adding additional screws or use bolts with nuts. Alternatively a localized piece of timber can be used to fix into.

Figure 6: Grind tile if necessary to accommodate thickness of Tile Bracket Arm

6.4 Fixing rail

Connection of the rail to the roof mounts is simply achieved by aligning T-Bolt on mounts with slot on rail and then pushing the T-Bolt into the slot. Once this is achieved the M8 lock nut can be tightened. The T-Bolt will lock and bind into the aluminium rail.

Stainless steel fasteners are particularly susceptible to thread galling. During the tightening of the fastener, pressure builds between the contacting thread surfaces and breaks down the protective oxide coatings. With the absence of the oxide coating, the metal high points of the threads are exposed to one another, which increases friction. The combination of these two events can generate enough heat to fuse and seize the nut and bolt together. Lowering the wrench speed during installation and removal can help avoid galling.

Tip: The mounts have vertical slots to allow for alignment of the rail in case of roof not being perfectly flat.

Tip: The ends of the bottom and top rails should be aligned; this will make it easier to align Solar panels once they are installed.

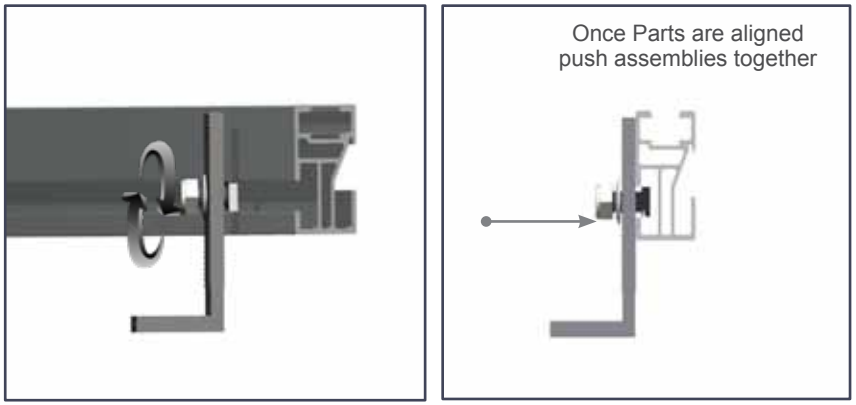


Figure 7: Align T-Bolt and insert, quarter turn will start to lock in place

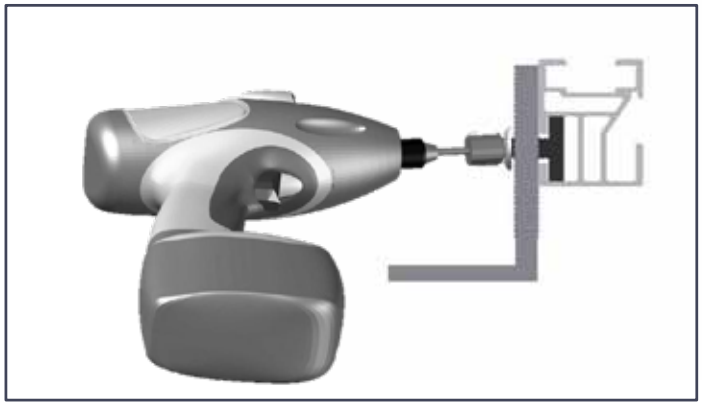


Figure 8: Tighten Locknut once in correct position

Tip: It is recommended that the M8-Nuts be tightening using a ratchet spanner or Clutch type drill/driver. The tightening torque should be around 20 N.m. Do not use a impact driver for these as the torque on these are not adjustable and often in excess of 150 N.m.

6.5 Rail Joiner

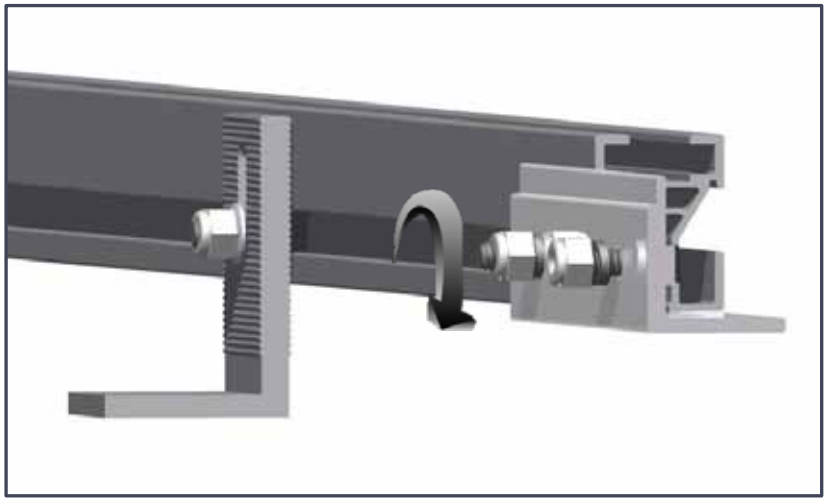


Figure 9: Tighten Locknut once in correct position.

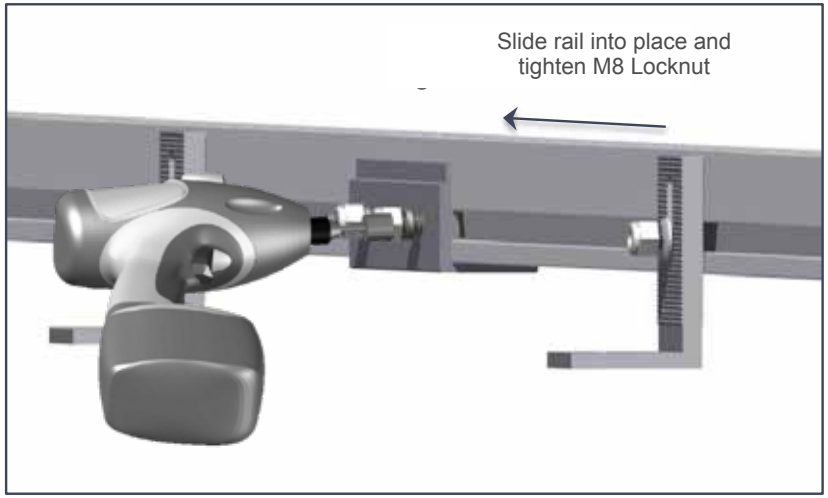


Figure 10: Complete by sliding rail in place and tightening Locknut

The corresponding rail simply slides into the joiner and butted against the other rail. The assembly is then held in place while tightening the M8 Locknut. (See Figure 10)

Tip: It is recommended that the M8-Nuts be tightened using a ratchet spanner or Clutch type drill/driver. Please see previous note regarding tightening torque.

Note: The Joiner assembly incorporates serrated washers that will penetrate the Aluminium rails and create the earth bond between the two lengths of rail. This is part of the mount system Earth Bonding.

Rail lengths should be limited to 12.5mts to avoid thermal expansion affects.

Tip: Rail Length (RL) formula; RL = n x w + (n-1)20 + 100 , where; n= no. of panels, w = width of panels. This allows for 20mm overhang on each side.

6.6 Installing End Clamps

The end clamps are pre- slotted to accept panel thicknesses of 30, 35, 40, 45 or 50mm. A rubber band prevents the two components that make up the end-clamp from coming apart during transport and assembly. This can be cut off after installation. Pre-set the end clamps to the appropriate thickness and place into rail (See Figure 11). The T-Bolt is inserted as per previous examples.

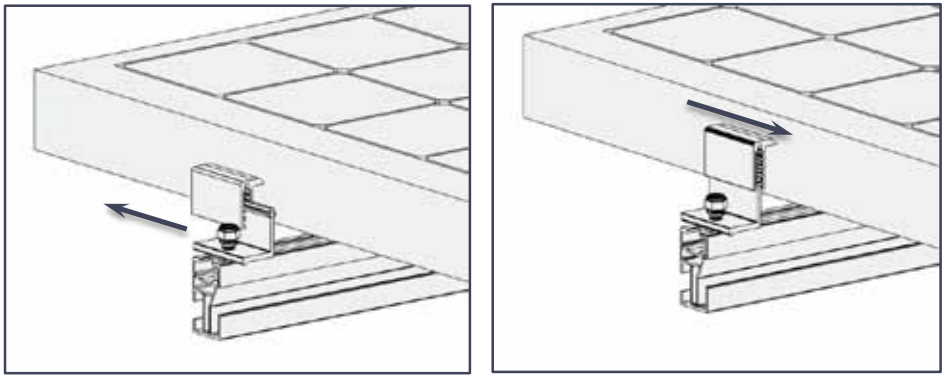


Figure 11: Slide top of end clamp out and insert at correct thickness

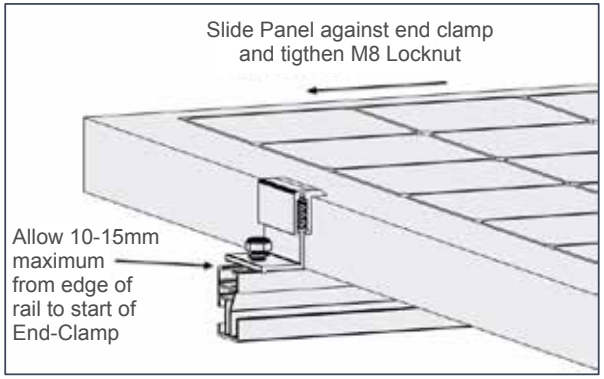


Figure 12: Slide Panel against end-clamp and tighten Locknut

Insert the first solar panel to the railing starting as close to the end of the rail as possible (design allows for 15mm max.) Tighten the M8 Nut to the recommended torque setting. (See Figure 12)

Tip: If rails were aligned properly, the first panel should be set perpendicular to the rail, once this is done on the first panel the remainder can be installed without adjustment.

6.7 Installing Mid Clamps

The mid clamps are designed to accommodate any panel thicknesses from 30-52mm without disassembly. Place the mid clamp into the rail (T-Bolt is inserted as per previous) and by using hand pressure only, turn the nut clockwise so that the T-Bolt engages the rail. (see Figure 13).

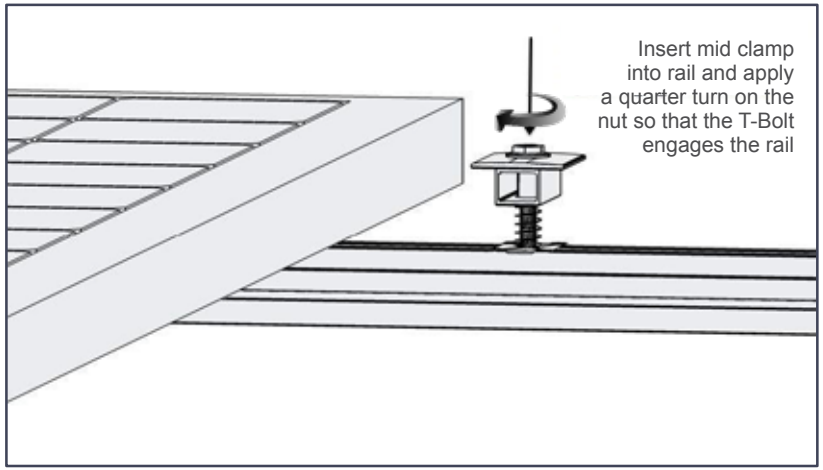


Figure 13: Inserting Mid Clamp into rail

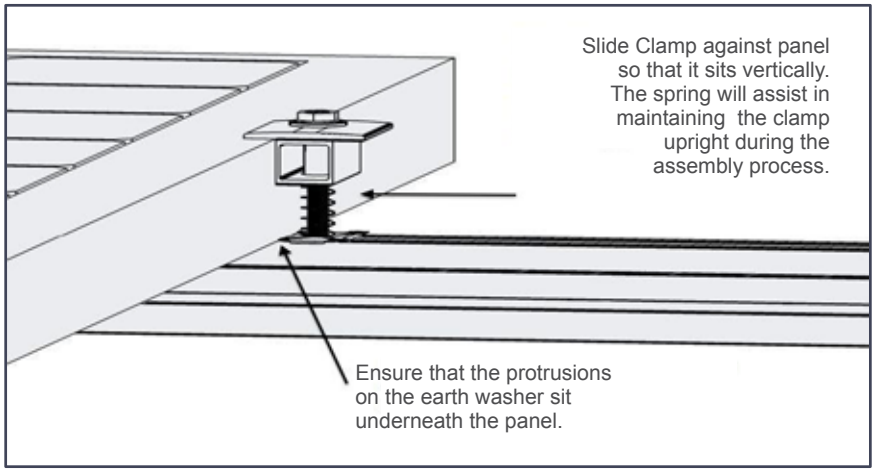

Slide Clamp against panel so that it sits vertically. The spring will assist in maintaining the clamp upright during the assembly process.
Ensure that the protrusions on the earth washer sit underneath the panel.

Figure 14: Slide Clamp against panel

Slide the mid clamp against first panel so that there is no gap between the clamp and panel. The clamps come in two variants; one with earth washer and one without. Refer to Earthing section in this document on placement of these components. If an earth washer is on the mid-clamp please ensure that the washer is correctly aligned and the protruding nibs are between the panel and the rail. (See Figure 14)

Note: The mid-clamps have some thread locking compound which makes it easy to insert and remove T-bolt from rail. The nut cannot be hand tightened.
Mid-clamps have a spring which maintains the clamp upright during installation. There is no need to hold the clamp when installing next corresponding panel.

Install the next panel and tighten the M8 Nut to the recommended torque setting. (See Figure 15)

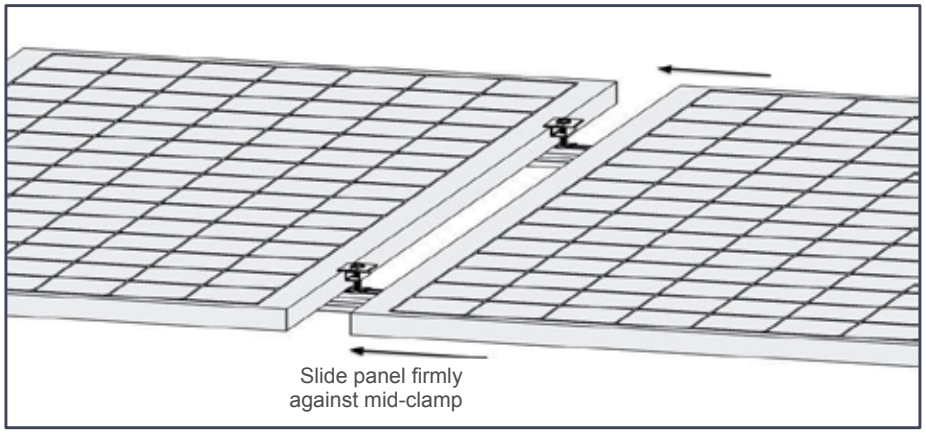


Figure 15: Install remainder of panels

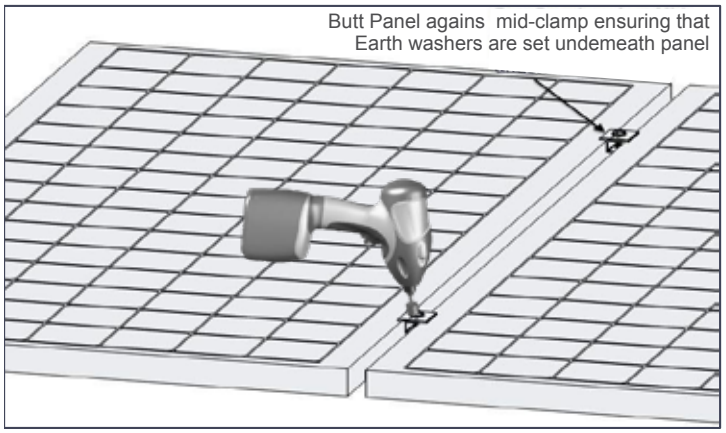


Figure 16: Install Reminder of panels and tighten Locknuts

Tip: Check for alignment after installation of second panel

Clamp the remainder of the panels and finish off the last panel in the array with end clamps.

6.8 Cable Tray

The 360Rack mount system incorporates a cable tray with proprietary clipping system that avoids the use of cable ties and fulfills the new requirements of AS5033. Please refer to Figure 17;

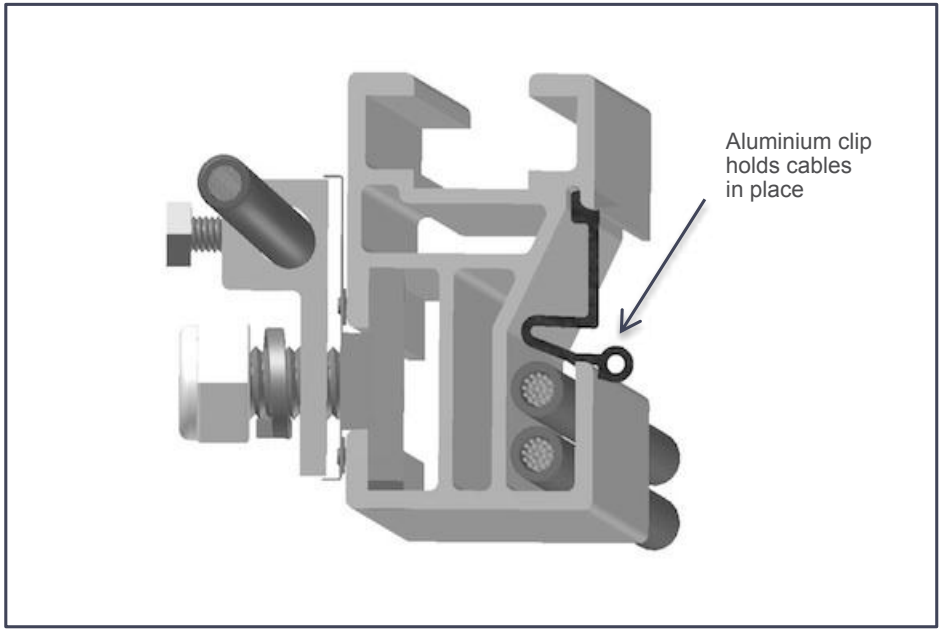


Figure 17: Sliding Clamp against panel

6.8 Earthing

An earth bonding solution is included with the Mounting system, this includes (See Figure 18);

i. A rail Earthing Lug;
ii. Mid-Clamps with Earthing washers,
iii. Rail Joiners with Earthing washers.

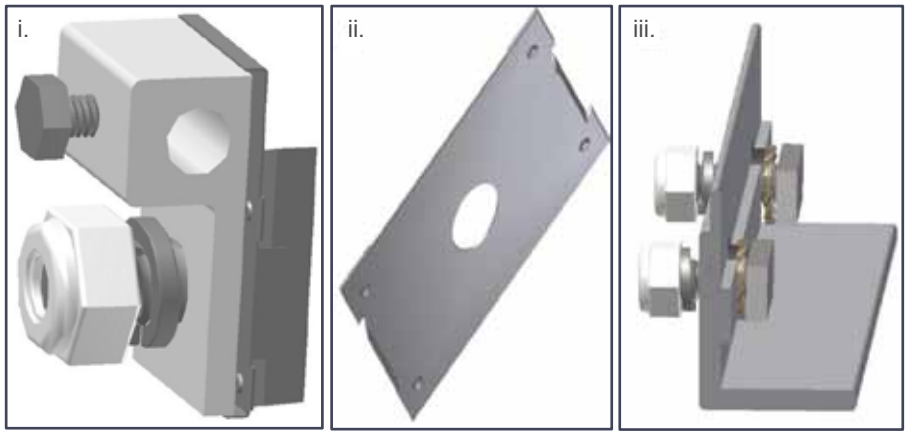


Figure 18: Rail, Panel and Joiner Earthing respectively

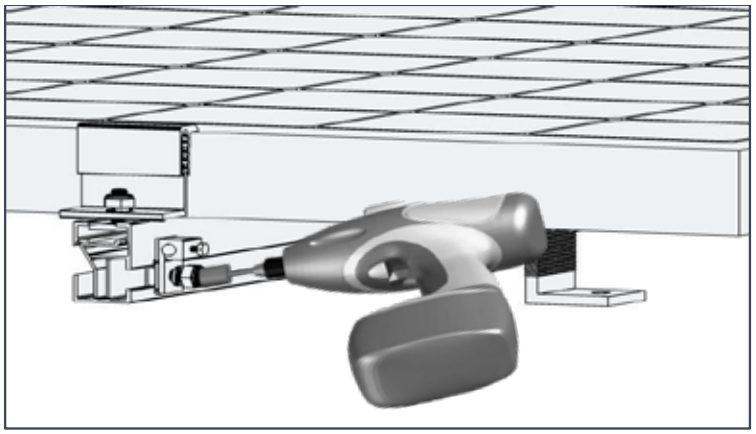


Figure 19: Tighten Earth Lug Locknut once in place

The joiner and mid clamp earthing are integrated into each assembly and automatically are functional by following the previous installation steps for these components.

The rail-earthing lug should be attached to one rail only in any one continuous array of panels. Where the array is split, another earthing lug must be installed on each array.
The Rail Earthing lug is preassembled and includes a T-bolt assembly and an Earthing washer ready to fit into the rail. The T-Bolt is inserted (as per previous examples) and the M8 nut tightened ensuring that the earthing washer is properly aligned with rail slot. (See Figure 19)

The Earth cable can then be stripped and inserted into hole whereby the bolt can be tightened against the lug body. Guidelines from AS-3000, AS-5033 and AS-4777 should also be incorporated. (See Figure 20)

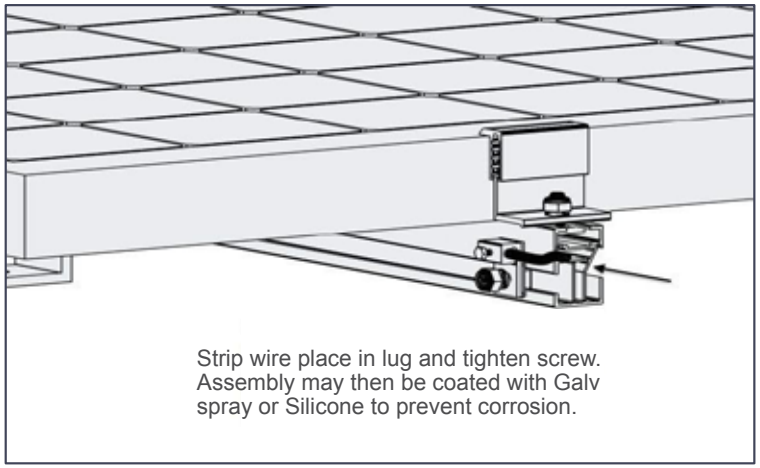


Figure 20: Insertion of Earthing wire

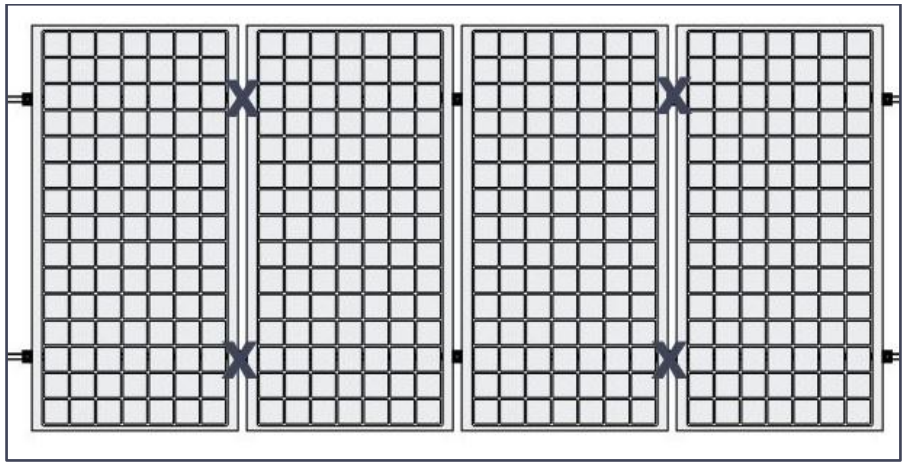


Figure 21: Mid Clamp with Earthing Positions on Even No. of Panels

Tip: It is recommended that lug be either sprayed with Galv Spray or sealed with Silicone to ensure long-term contact of the Earth wire with the Lug frame. It also is beneficial to install the Lug underneath one of the panels as to create a shield from environmental effects.

Layouts: The mid clamps come in two variants; one with earth washer and one without. The clamps with Earth washers are placed in an array depending on the number of panels in the array;

For Even numbers of panels: Where; X = denotes the placement of a Mid-clamp with earth washer.
For even number of panels, the required amount of panel Earthing washers is given by; P x A Where; P = No. Of panels, A = Number of Arrays. i.e. In above case, No. of mid clamp with earthing washers required is 4 x 1 = 4

For Odd numbers of panels: Where; Where; X = denotes the placement of a Mid-clamp with earth washer.
For odd number of panels, the required panel Earth washers is given by; (P+1) x A Where; P = No. of panels, A = Number of Arrays
i.e. In above case, No. of mid-clamps with earth washers required is (5+1) x 1 = 6

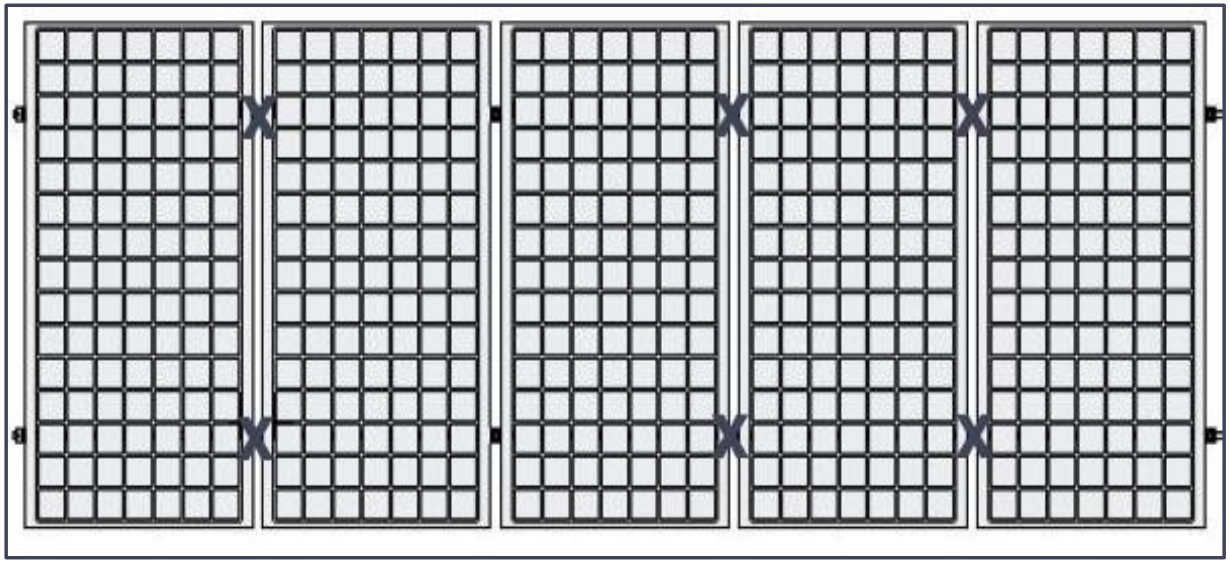


Figure 22: Mid Clamp with Earthing Positions on Odd No. of Panels

7. TILT SYSTEM INSTALLATION

7.1 Planning and Preparation

After considering layout and planning job, consult with wind design data at back of this document to ascertain the correct number of Tilt frames required for the rail length being used.

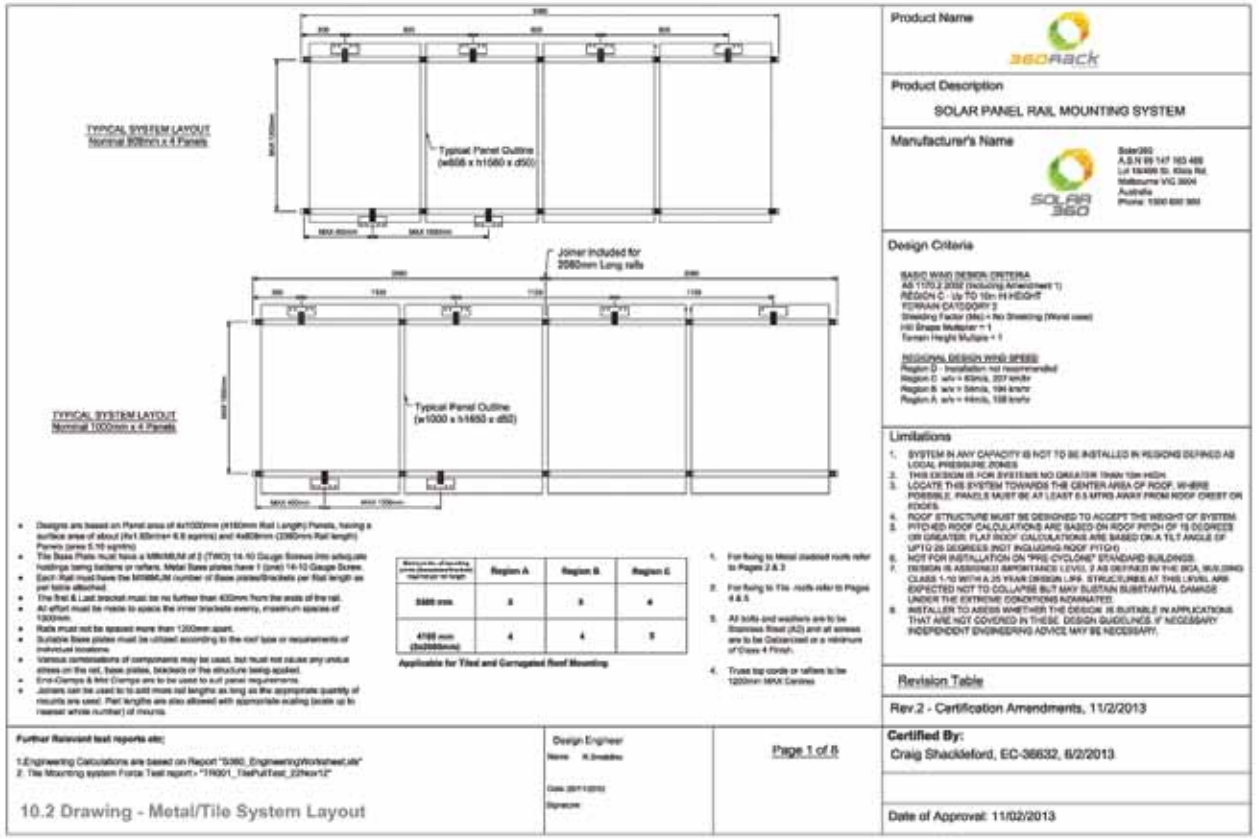


Figure 23: Typical Wind Design drawing

Tip: Try to plan job in groups of 2 or 4 panels, the panel widths are designed to cater for nominal 800 and 1000mm panel widths without cutting. panel widths can be joined to make any continuous length up to 12.5MT (Limit imposed due to thermal expansion considerations)

7.2 Install Tilt Base Plates

Install Tilt Frame base with Galvanised 17-10x75 Screw provided driven into batten (In some cases Truss or rafter). (See Figure 24) Rubber isolators are included in the Tilt frame kit. These should be used in-between the Tilt base and roof where penetrations are performed.

Tip: For a steel roof with hidden fixings, determine where the battens are by using a stud finder or by " feel" i.e. standing along the valley section of the roofing material until firmness is felt. This point can be marked and the procedure repeated until a straight line of markings is determined.

Note: The Tilt base has three slots that are used to fix it onto the roof surface. In most case the batons are spaced between 800-1200 mm apart and the outer two slots can be used. In cyclone areas or where specific building requirements are imposed the spacing maybe 600mm in which case the central slot is also used.

Note: The Tilt assembly consists of three main components; the base, the top and the adjustable tilt arm. The later two components are allowed to pivot on the base so that they can be placed out of harm way when fixing the base into the roof material.

Tip: In order to avoid slippage of the screw point it is prudent to indent roof sheet with point of screw by giving a tap with a hammer to top of screw head.

Tip: An impact driver that requires no pre-drilling best performs this function.

The remainder of the Tilt frames can be installed paying particular attention to making sure the frames are aligned.

General Note for Fixing into Steel Purlins:

For steel roof Purlins, M6 Zip screws should be used, if material thickness is less than 1mm then an additional screw must be used at every fixing point. (Refer to Engineering drawings at end of document)

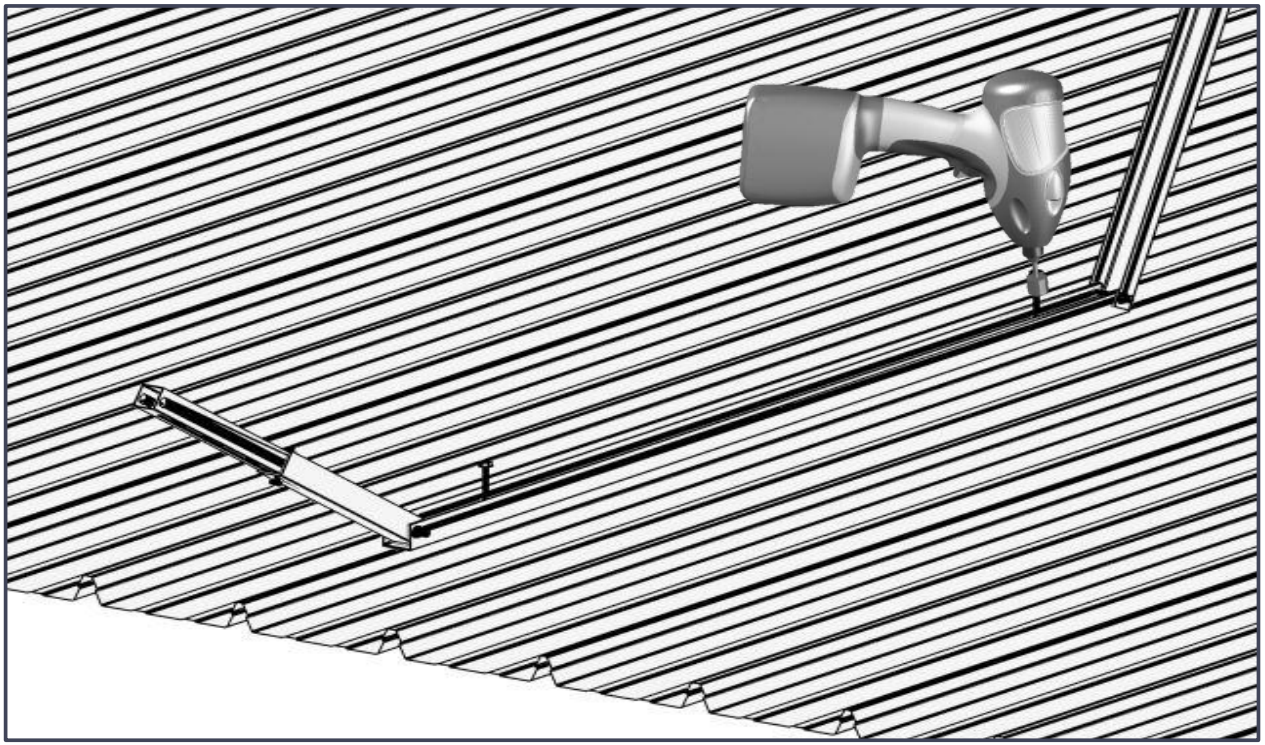


Figure 24: Fixing Tilt Base to roof

7.3 Setting the Adjustable tilt Arm

The Tilt arm has an inner section that slides up or down, with a series of holes that align to give adjustment of nominal 15, 20, 25, and 28 degrees of extra tilt over and above the exisiting roof surface angle. A pin is provided to lock the inner and outer section at the correct angle. (See Figure 25)

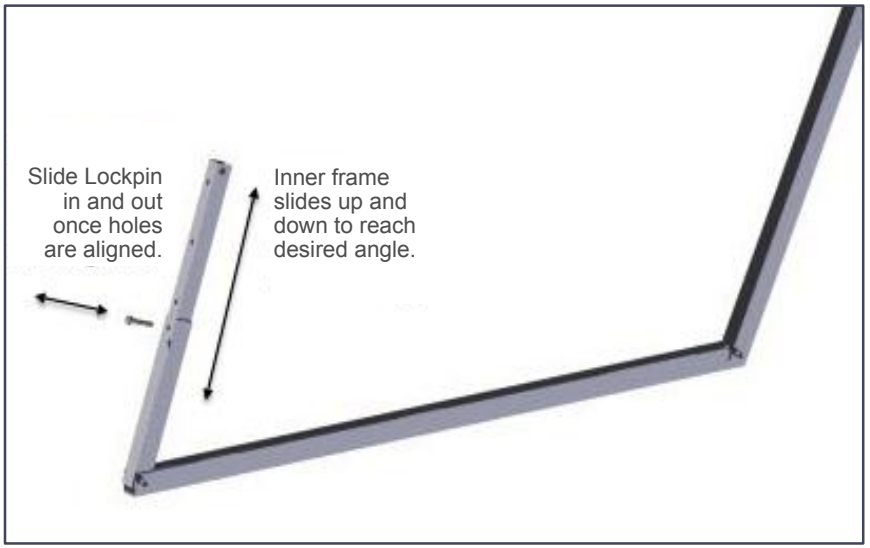


Figure 25: Set Extendable arm to desired setting and Lock with pin supplied

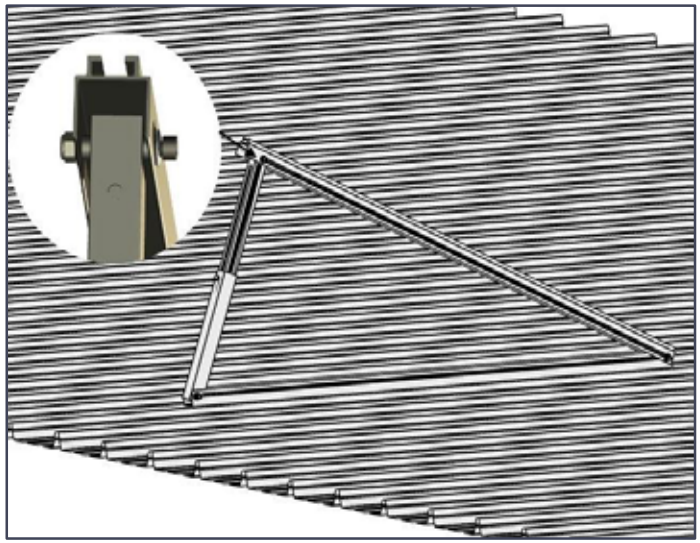


Figure 26: Connect Adjustable arm and Top section together

Once the angle is set the Adjustable Tilt arm is connect to the Top Rail section as shown in Figure 26.

Tip: It is recommended that the M8-Nuts be tightened using a ratchet spanner or Clutch type drill/driver. The tightening torque is approximately 20 N.m. To aid in tightening nut a 6mm Allen key is required to prevent the corresponding screw from rotating.

The remainder of the pivot points should all now be tightened as per procedure above.

7.4 Installing the rail

The rail is held in place by clamps that are supplied with the Tilt assembly. The clamps are first paced into the mount rails as shown in Figure 27.

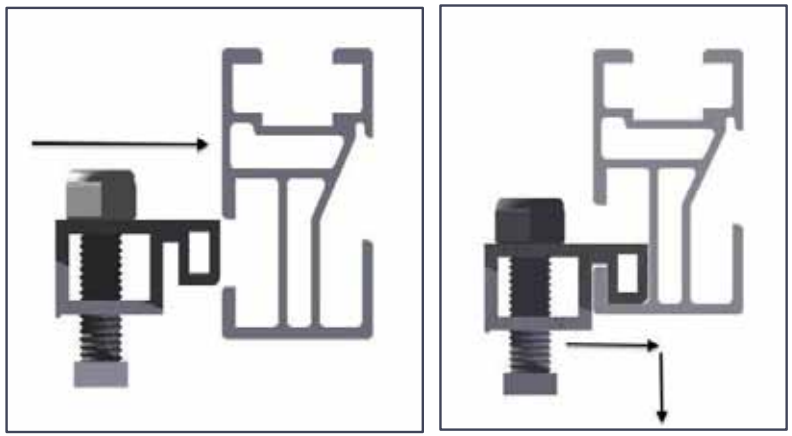


Figure 27: Insertion of tilt Rail Clamps

Figure 28: Tighten Locknuts on clamps once rail is in correct position

The assembly can then be placed on the Tilt Rail arm and the T-Bolt on the clamp tightened to clamp the rail in place. This procedure is repeated for all the Tilt frame assemblies along the length of the rail. (See Figure 28)

7.5 Installation of Panels

Refer to section 6.iii to 6.vii for reminder of installation.

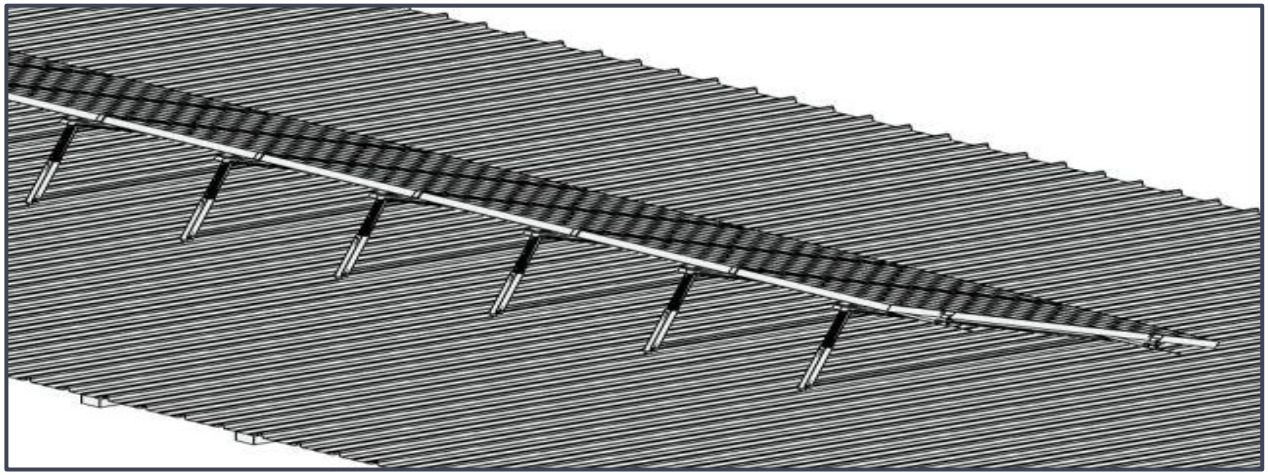


Figure 29: Install Remainder of panels as per previous

8. WARRANTY PROVISIONS

Limited Product Warranty – ten (10) year repair, replacement or refund remedy

Guarantee statement - Solar360 Pty Ltd's goods come with guarantees that cannot be excluded under the Australian Consumer Law. You are entitled to a replacement or refund for a major failure and for compensation for any other reasonably foreseeable loss or damage. You are also entitled to have the goods repaired or replaced if the goods fail to be of acceptable quality and the failure does not amount to a major failure.

Solar360 Pty Ltd ("Solar360") hereby confirms that its 360Rack Solar PV Racking System is compliant with The Building Code of Australia, AS/NZ 1664 part 1, AS 5033-2012, AS 1866, AS/NZ 1170.0, AS/NZ 1170.1, AS/NZ 1170.2, AS 3566 and AS 4100 as at the date of purchase and comprise of quality components (aluminium / stainless steel).

Solar360 warrants that the Racking System is free from faulty parts, manufacture or workmanship when installed in accordance with Solar360's Installation Manual ("Warranty") commencing from date of purchase and will expire within ten (10) years from the date of purchase ("Warranty Period").

The Racking System must be installed according to Solar360's Installation Manual, otherwise this Warranty will be void. This Warranty is offered to the original purchaser and is not assignable or transferrable.

The Warranty only applies where, during the Warranty Period, a defect has arisen in the Racking System, wholly or substantially, as a result of faulty manufacture, parts or workmanship in the Racking System.

To the maximum extent permitted by law, if the Racking System fails to conform to the Warranty during the Warranty Period, Solar360 will, at its option, either repair or replace the Racking System, or refund the purchase price for the Racking System as paid by the original purchaser.

To the maximum extent permitted by law, the repair, replacement or refund remedy shall be the sole and exclusive remedy and in lieu of all others, express or implied and shall not extend beyond the Warranty Period.

Exclusions and Limitations

The Warranty does not apply where damage is caused by other factors, including without limitation:

- Alteration, repair, service or modification of the Racking System without the express, prior written consent of Solar360;
- Removal of the Racking System and reinstallation of it at another site;
- Non-compliance with Solar360's Installation Manual;
- Misuse, abuse, neglect, or accident in storage, transportation, handling, installation, application, use or service;
- Power failures, power surges, lighting, flood, fire, vandalism, tampering, accidental breakage, mould discolouration, or any acts of God or other events beyond Solar360's control.

In addition, the Warranty does not cover any cosmetic blemishes, for example any blemishes associated with installation, normal wear and tear, or excessive dirt build-up.

Without detracting from the rights and benefits under the Australian Consumer Law, Solar360 excludes all liability, whether in contract, tort (including negligence), strict liability or by virtue of the breach of any statutory duty or otherwise. Solar360 will not be liable whatsoever for any damage to products sold in conjunction with Racking System or any damage resulting from the installation and assembly of Racking.

System. Any claim in relation to another manufacturer's product is to be made to that manufacturer directly.

To the maximum extent permitted by law, Solar360's aggregate liability, if any, in damages or otherwise, shall not exceed the purchase price paid to Solar360 by the customer. Solar360 will not be liable for any labour costs, injury, damage, or any consequential costs associated with replacing the defective Racking System.

Making a Warranty claim

Claims under the Warranty must be received by Solar360 within the Warranty Period, without exception. The original purchaser must provide the original proof of purchase and provide all such evidence as may be required by Solar360 to demonstrate the validity of the original purchaser's claim.

Warranty claims may only be made by, or on the behalf of the original purchaser.

You must notify Solar360 in writing within fourteen (14) business days after the date when the malfunction or defects provided under this Warranty have been found.

Miscellaneous

The repair or replacement of the Racking System does not cause the beginning of new Warranty terms, nor shall the original terms of this Warranty be extended.

Solar360 has the right to deliver another type (different in size, colour, shape and/or power) in the event that Solar360 has discontinued producing the Racking System or limited stock in question at the time of the claim.

If any part or provision of the Warranty is held invalid, void or unenforceable, that will not invalidate the remaining parts or provisions of the Warranty, which shall remain in full force.

9. MAINTENANCE

The main components are all made from either Aluminium or Stainless steel and there are no moving parts. Anodising of the Aluminium surface provides extra assurance against corrosion. Incorporation of dual redundancy in thread locking also increases reliability. By design, the system does not require any maintenance.

In marine environments or areas subject to high pollution, rinsing with clean water may be performed at recommended intervals supplied by panel supplier.

10. WIND LOAD CONSIDERATIONS

In order to claim Renewable Energy Certificates (REC's), an installer must sign off that the mounting system complies with the requirements of buildings and structures in relation to Wind Loads imposed according to AS1170.2. The mounting system must also be installed according to manufacturer's guidelines.

The following pages compose of the compliance documents of the 360Rack system to AS1170.2. The associated drawings define the parameters of how the system should be installed for various roof types. The installer should become familiar with these documents and ensure that installation complies with the parameters imposed.

General limitations and design principles;

Claims under the Warranty must be received by Solar360 within the Warranty Period, without exception. The original purchaser The following installation limitations of the system shall apply:

1. Installed in a location with a Wind Region of no greater than Region C.

2. Height of roof level above ground shall not exceed 10 metres.

3. System is to be located towards centre of roof. Edges of solar panels to be at least 500mm from crest or edge of roof.

4. Roof structures and roof elements, including battens, rafters, trusses, etc. are to be designed and/or verified by an suitably qualified person to accept the superimposed loads of the system.

5. Pitched roofs of between 15 to 50 degrees. Flat roofs of 1 to 5 degrees for tilt frames with an angle of 25 degrees.

6. Not to be installed on "pre-cyclone" designed buildings.

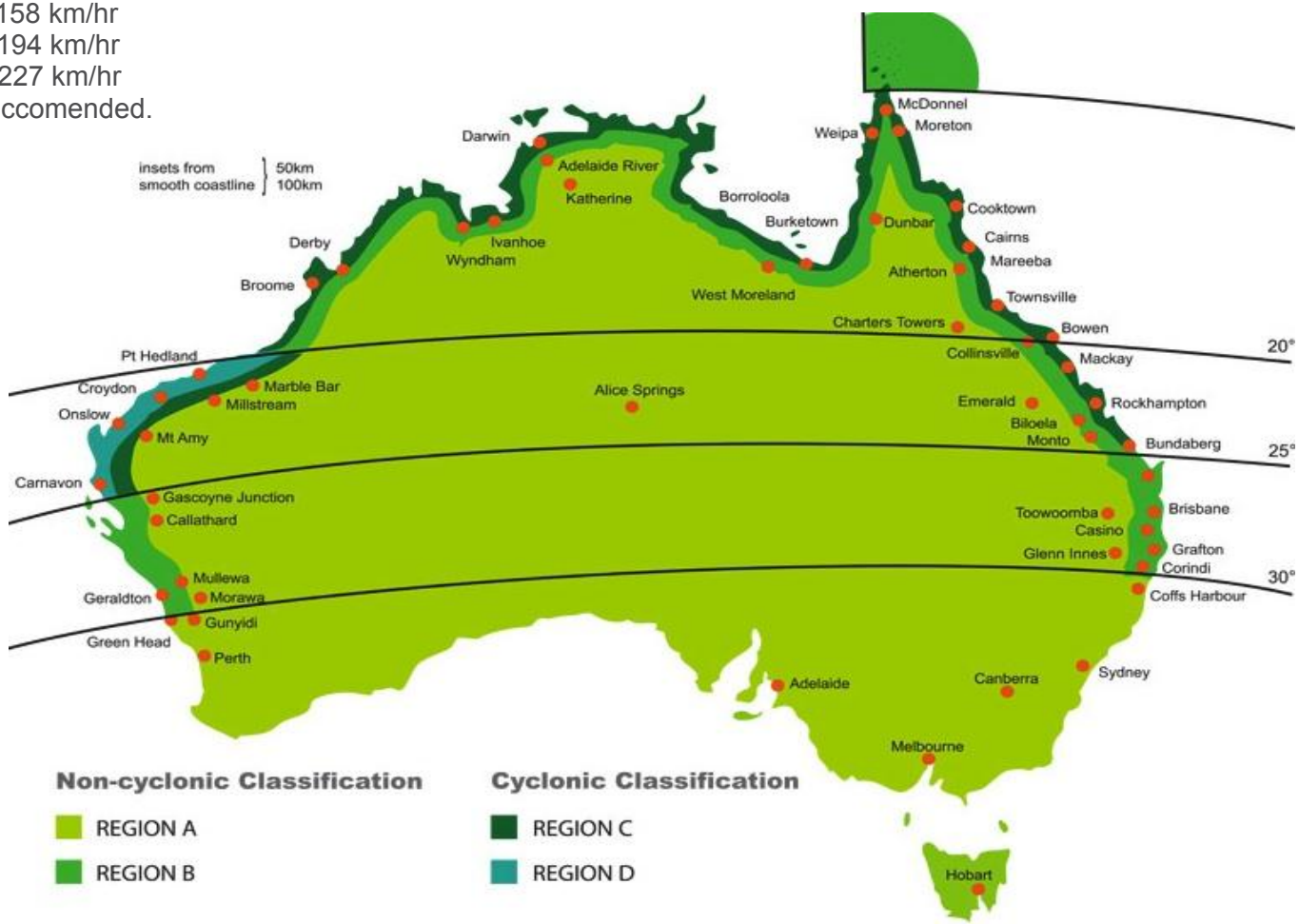
7. Design is based on Importance Level 2 in accordance with BCA, Building Class 1 to 10, with a 25 year design life.

8. If any of the above limitations do comply the installer shall seek independent engineering certification for the necessary installation requirements of the system.

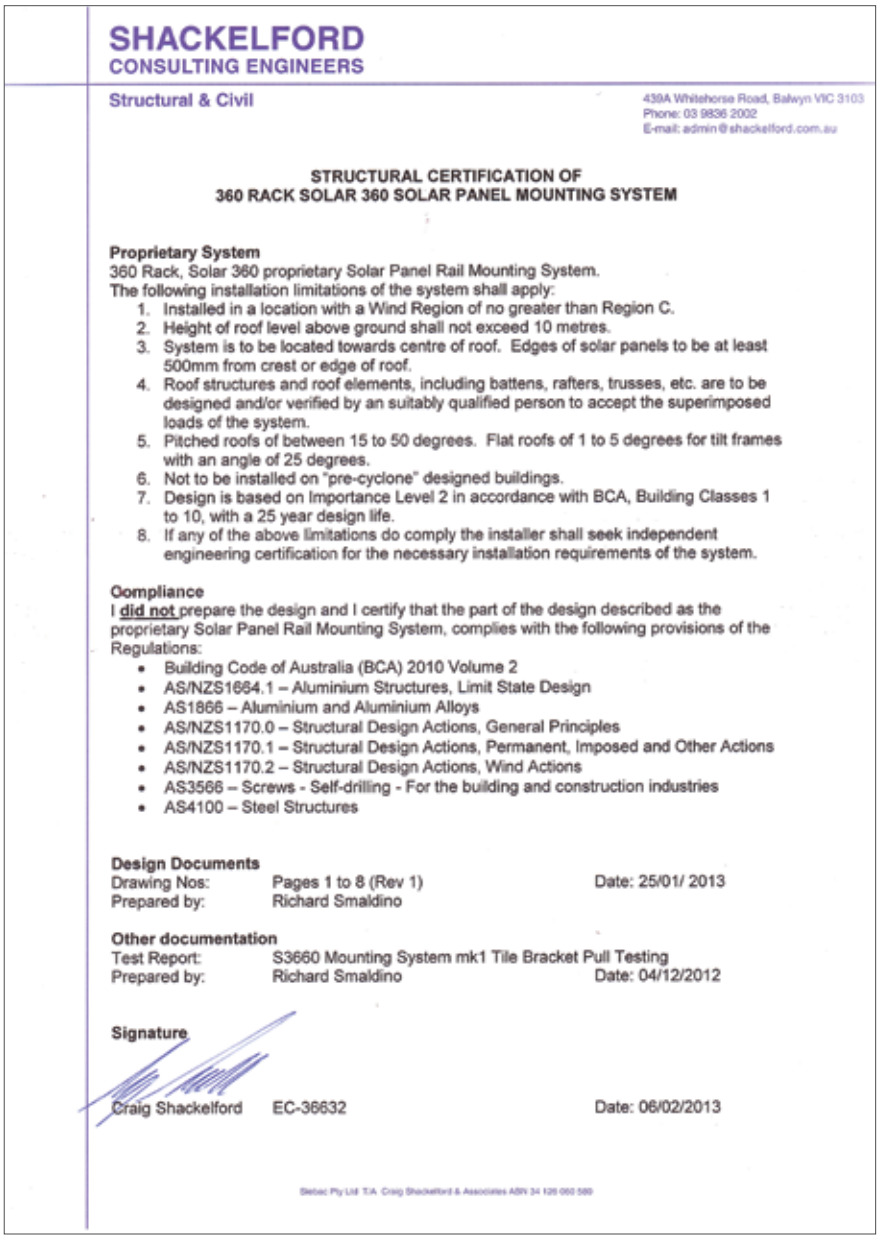
Regional Design Wind Velocity (WV);

Region A, WV = 44 m/s, or 158 km/hr
Region B, WV = 54 m/s, or 194 km/hr
Region C, WV = 63 m/s, or 227 km/hr
Region D, Installation not reccomended.

Wind Region Map



10.1 Wind Load Certificate



SHACKELFORD
CONSULTING ENGINEERS

Structural & Civil

439A Whitehorse Road, Balwyn VIC 3103
Phone: 03 9836 2002
E-mail: admin@shackelford.com.au

STRUCTURAL CERTIFICATION OF
360 RACK SOLAR 360 SOLAR PANEL MOUNTING SYSTEM

Proprietary System
360 Rack, Solar 360 proprietary Solar Panel Rail Mounting System.
The following installation limitations of the system shall apply:

1. Installed in a location with a Wind Region of no greater than Region C.
2. Height of roof level above ground shall not exceed 10 metres.
3. System is to be located towards centre of roof. Edges of solar panels to be at least 500mm from crest or edge of roof.
4. Roof structures and roof elements, including battens, rafters, trusses, etc. are to be designed and/or verified by an suitably qualified person to accept the superimposed loads of the system.
5. Pitched roofs of between 15 to 50 degrees. Flat roofs of 1 to 5 degrees for tilt frames with an angle of 25 degrees.
6. Not to be installed on "pre-cyclone" designed buildings.
7. Design is based on Importance Level 2 in accordance with BCA, Building Classes 1 to 10, with a 25 year design life.
8. If any of the above limitations do comply the installer shall seek independent engineering certification for the necessary installation requirements of the system.

Compliance
I **did not** prepare the design and I certify that the part of the design described as the proprietary Solar Panel Rail Mounting System, complies with the following provisions of the Regulations:

- Building Code of Australia (BCA) 2010 Volume 2
- AS/NZS1664.1 – Aluminium Structures, Limit State Design
- AS1866 – Aluminium and Aluminium Alloys
- AS/NZS1170.0 – Structural Design Actions, General Principles
- AS/NZS1170.1 – Structural Design Actions, Permanent, Imposed and Other Actions
- AS/NZS1170.2 – Structural Design Actions, Wind Actions
- AS3566 – Screws - Self-drilling - For the building and construction industries
- AS4100 – Steel Structures

Design Documents

Drawing Nos:	Pages 1 to 8 (Rev 1)	Date: 25/01/ 2013
Prepared by:	Richard Smaldino	

Other documentation

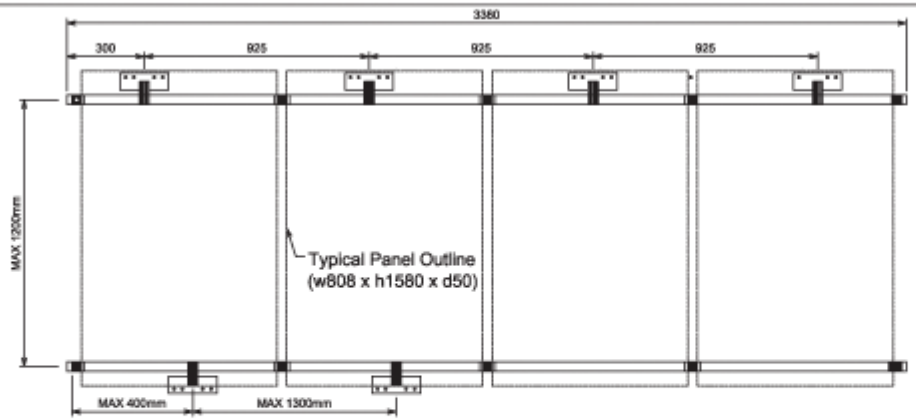
Test Report:	S3660 Mounting System mk1 Tile Bracket Pull Testing	
Prepared by:	Richard Smaldino	Date: 04/12/2012

Signature

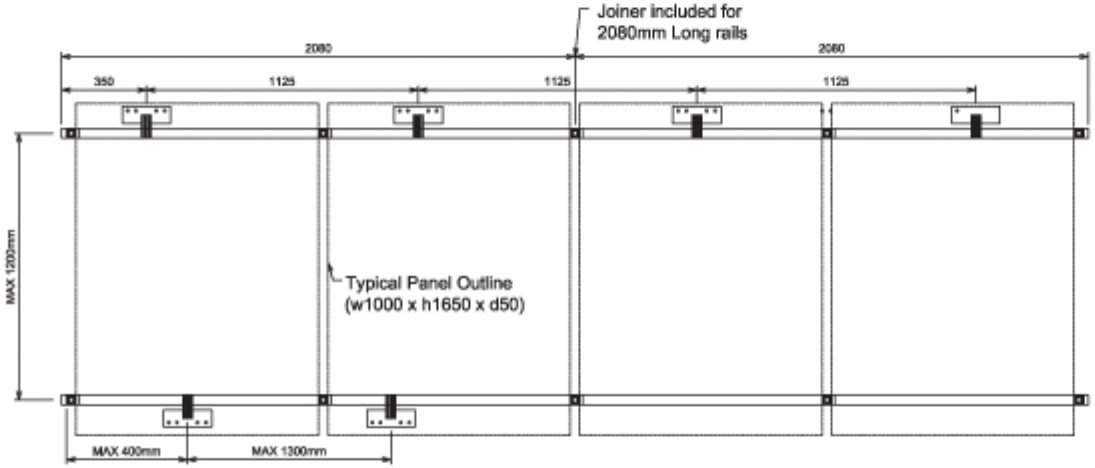
Craig Shackelford EC-36632 Date: 06/02/2013

TECHNICAL DRAWINGS
Appendix A

TYPICAL SYSTEM LAYOUT
Nominal 808mm x 4 Panels



TYPICAL SYSTEM LAYOUT
Nominal 1000mm x 4 Panels



- Designs are based on Panel area of 4x1000mm (4160mm Rail Length) Panels, having a surface area of about (4x1.65mtrs= 6.6 sqmtrs) and 4x808mm (3380mm Rail length) Panels (area 5.16 sqmtrs)
- Tile Base Plate must have a MINIMUM of 2 (TWO) 14-10 Gauge Screws into adequate holdings being battens or rafters. Metal Base plates have 1 (one) 14-10 Gauge Screw.
- Each Rail must have the MINIMUM number of Base plates/Brackets per Rail length as per table attached.
- The first & Last bracket must be no further than 400mm from the ends of the rail.
- All effort must be made to space the inner brackets evenly, maximum spaces of 1300mm.
- Rails must not be spaced more than 1200mm apart.
- Suitable Base plates must be utilized according to the roof type or requirements of individual locations.
- Various combinations of components may be used, but must not cause any undue stress on the rail, base plates, brackets or the structure being applied.
- End-Clamps & Mid Clamps are to be used to suit panel requirements.
- Joiners can be used to to add more rail lengths as long as the appropriate quantity of mounts are used. Part lengths are also allowed with appropriate scaling (scale up to nearest whole number) of mounts.

Minimum No. of mounting points (Baseplates/Brackets) required per rail length	Region A	Region B	Region C
3380 mm	3	3	4
4160 mm (2x2080mm)	4	4	5

Applicable for Tiled and Corrugated Roof Mounting

1. For fixing to Metal cladded roofs refer to Pages 2 & 3
2. For fixing to Tile roofs refer to Pages 4 & 5
3. All bolts and washers are to be Stainless Steel (A2) and all screws are to be Galzanized or a minimum of Class 4 Finish.
4. Truss top cords or rafters to be 1200mm MAX Centres

Further Relevant test reports etc;

1.Engineering Calculations are based on Report "S360_EngineeringWorksheet.xls"
2. Tile Mounting system Force Test report:- "TR001_TilePullTest_22Nov12"

10.2 Drawing - Metal/Tile System Layout

Design Engineer
Name: R.Smaldino
Date: 20/11/2012
Signature:

Product Name

360Rack

Product Description

SOLAR PANEL RAIL MOUNTING SYSTEM

Manufacturer's Name

Solar360
A.B.N 99 147 163 488
Lvl 18/499 St. Kilda Rd.
Melbourne VIC 3004
Australia
Phone: 1300 600 360

Design Criteria

BASIC WIND DESIGN CRITERIA
AS 1170.2.2002 (Including Amendment 1)
REGION C - Up TO 10m IN HEIGHT
TERRAIN CATEGORY 2
Shielding Factor (Ms) = No Shielding (Worst case)
Hill Shape Multiplier = 1
Terrain Height Multiple = 1

REGIONAL DESIGN WIND SPEED
Region D - Installation not recommended
Region C w/v = 63m/s, 227 km/hr
Region B w/v = 54m/s, 194 km/hr
Region A w/v = 44m/s, 158 km/hr

Limitations

1. SYSTEM IN ANY CAPACITY IS NOT TO BE INSTALLED IN REGIONS DEFINED AS LOCAL PRESSURE ZONES
2. THIS DESIGN IS FOR SYSTEMS NO GREATER THAN 10m HIGH.
3. LOCATE THIS SYSTEM TOWARDS THE CENTER AREA OF ROOF, WHERE POSSIBLE. PANELS MUST BE AT LEAST 0.5 MTRS AWAY FROM ROOF CREST OR EDGES.
4. ROOF STRUCTURE MUST BE DESIGNED TO ACCEPT THE WEIGHT OF SYSTEM.
5. PITCHED ROOF CALCULATIONS ARE BASED ON ROOF PITCH OF 15 DEGREES OR GREATER. FLAT ROOF CALCULATIONS ARE BASED ON A TILT ANGLE OF UPTO 25 DEGREES (NOT INCLUDING ROOF PITCH)
6. NOT FOR INSTALLATION ON "PRE-CYCLONE" STANDARD BUILDINGS.
7. DESIGN IS ASSIGNED IMPORTANCE LEVEL 2 AS DEFINED IN THE BCA, BUILDING CLASS 1-10 WITH A 25 YEAR DESIGN LIFE. STRUCTURES AT THIS LEVEL ARE EXPECTED NOT TO COLLAPSE BUT MAY SUSTAIN SUBSTANTIAL DAMAGE UNDER THE EXTREME CONDITIONS NOMINATED.
8. INSTALLER TO ASESS WHETHER THE DESIGN IS SUITABLE IN APPLICATIONS THAT ARE NOT COVERED IN THESE DESIGN GUIDELINES. IF NECESSARY INDEPENDENT ENGINEERING ADVICE MAY BE NECESSARY.

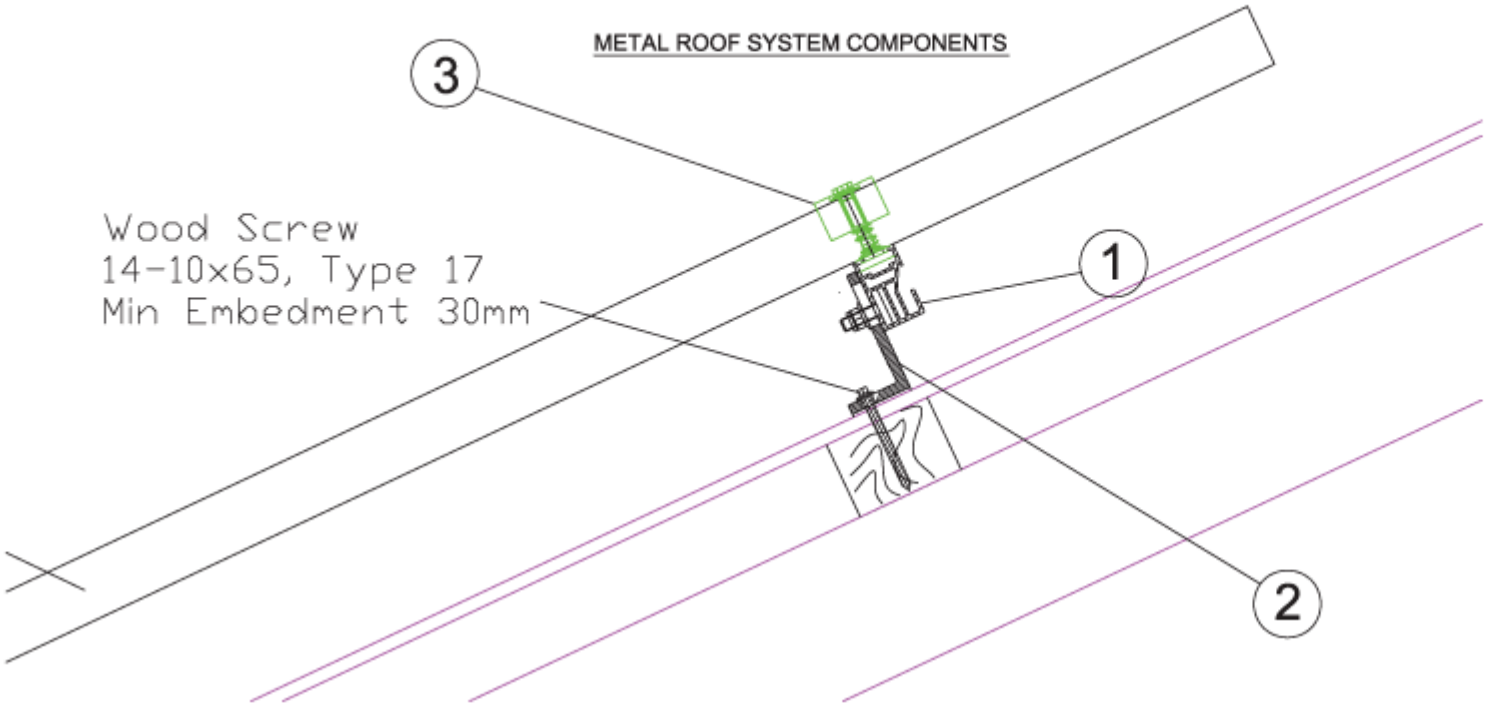
Revision Table

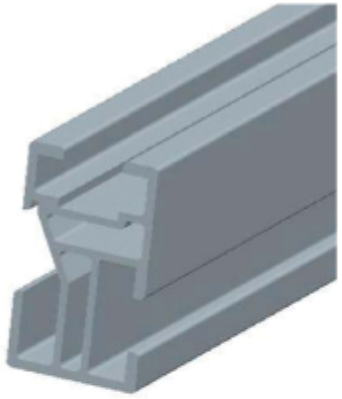
Rev.2 - Certification Amendments, 11/2/2013

Certified By:
Craig Shackleford, EC-36632, 6/2/2013

Date of Approval: 11/02/2013

METAL ROOF SYSTEM COMPONENTS





1. RAIL SECTION (A)
6063 T5 Aluminum extrusion
3380 & 2080 mm Typical

2. Metal Roof Base Plate (B)
6063 T5 Aluminum extrusion

3a. End Clamp (D)
6063 T5 Aluminum extrusion

3b. Mid Clamp (E)
6063 T5 Aluminum extrusion

Product Name

360Rack

Product Description

SOLAR PANEL RAIL MOUNTING SYSTEM

Manufacturer's Name

Solar360
A.B.N 99 147 163 488
Lvl 18/499 St. Kilda Rd.
Melbourne VIC 3004
Australia
Phone: 1300 600 360

Design Criteria

BASIC WIND DESIGN CRITERIA
AS 1170.2.2002 (Including Amendment 1)
REGION C - Up TO 10m IN HEIGHT
TERRAIN CATEGORY 2
Shielding Factor (Ms) = No Shielding (Worst case)
Hill Shape Multiplier = 1
Terrain Height Multiple = 1

REGIONAL DESIGN WIND SPEED
Region D - Installation not recommended
Region C w/v = 63m/s, 227 km/hr
Region B w/v = 54m/s, 194 km/hr
Region A w/v = 44m/s, 158 km/hr

Limitations

1. SYSTEM IN ANY CAPACITY IS NOT TO BE INSTALLED IN REGIONS DEFINED AS LOCAL PRESSURE ZONES
2. THIS DESIGN IS FOR SYSTEMS NO GREATER THAN 10m HIGH.
3. LOCATE THIS SYSTEM TOWARDS THE CENTER AREA OF ROOF, WHERE POSSIBLE. PANELS MUST BE AT LEAST 0.5 MTRS AWAY FROM ROOF CREST OR EDGES.
4. ROOF STRUCTURE MUST BE DESIGNED TO ACCEPT THE WEIGHT OF SYSTEM.
5. PITCHED ROOF CALCULATIONS ARE BASED ON ROOF PITCH OF 15 DEGREES OR GREATER. FLAT ROOF CALCULATIONS ARE BASED ON A TILT ANGLE OF UPTO 25 DEGREES (NOT INCLUDING ROOF PITCH)
6. NOT FOR INSTALLATION ON "PRE-CYCLONE" STANDARD BUILDINGS.
7. DESIGN IS ASSIGNED IMPORTANCE LEVEL 2 AS DEFINED IN THE BCA, BUILDING CLASS 1-10 WITH A 25 YEAR DESIGN LIFE. STRUCTURES AT THIS LEVEL ARE EXPECTED NOT TO COLLAPSE BUT MAY SUSTAIN SUBSTANTIAL DAMAGE UNDER THE EXTREME CONDITIONS NOMINATED.
8. INSTALLER TO ASESS WHETHER THE DESIGN IS SUITABLE IN APPLICATIONS THAT ARE NOT COVERED IN THESE DESIGN GUIDELINES. IF NECESSARY INDEPENDENT ENGINEERING ADVICE MAY BE NECESSARY.

Revision Table

Rev.2 - Certification Amendments, 11/2/2013

Further Relevant test reports etc;

1.Engineering Calculations are based on Report "S360_EngineeringWorksheet.xls"
2. Tile Mounting system Force Test report:- "TR001_TilePullTest_22Nov12"

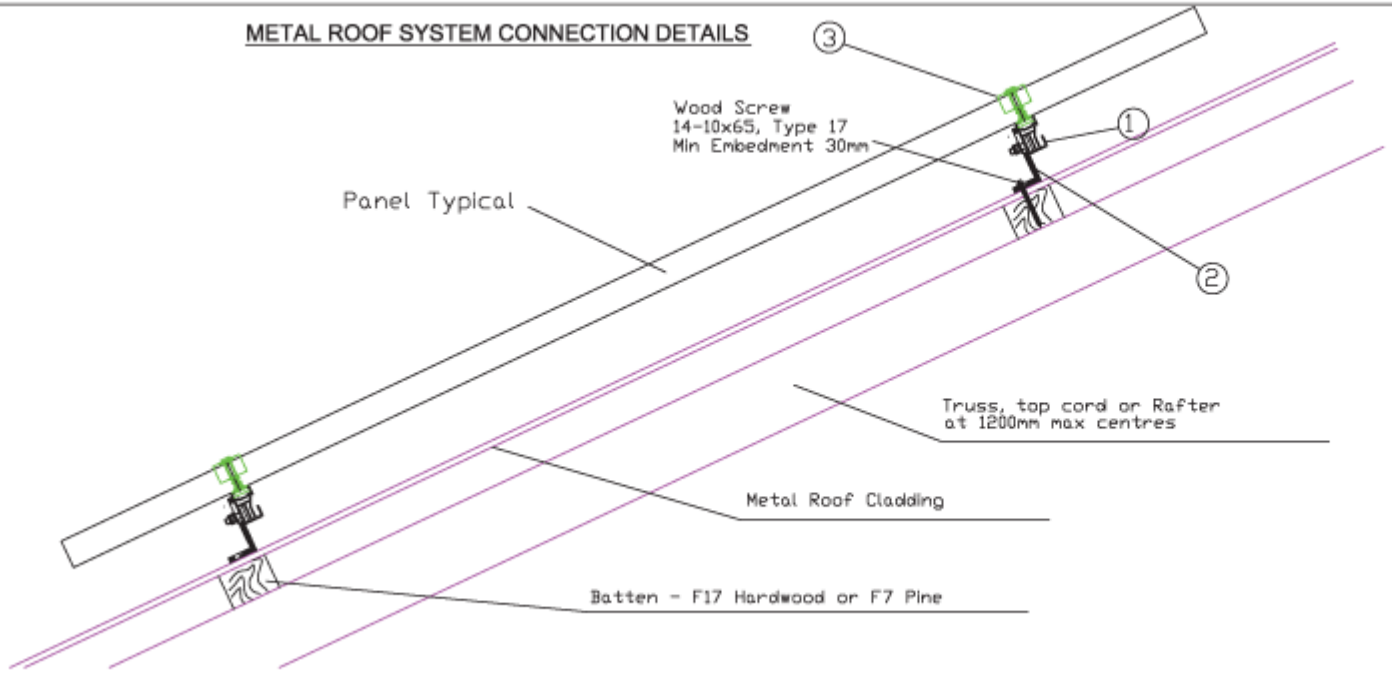
10.3 Drawing - Metal Roof Components

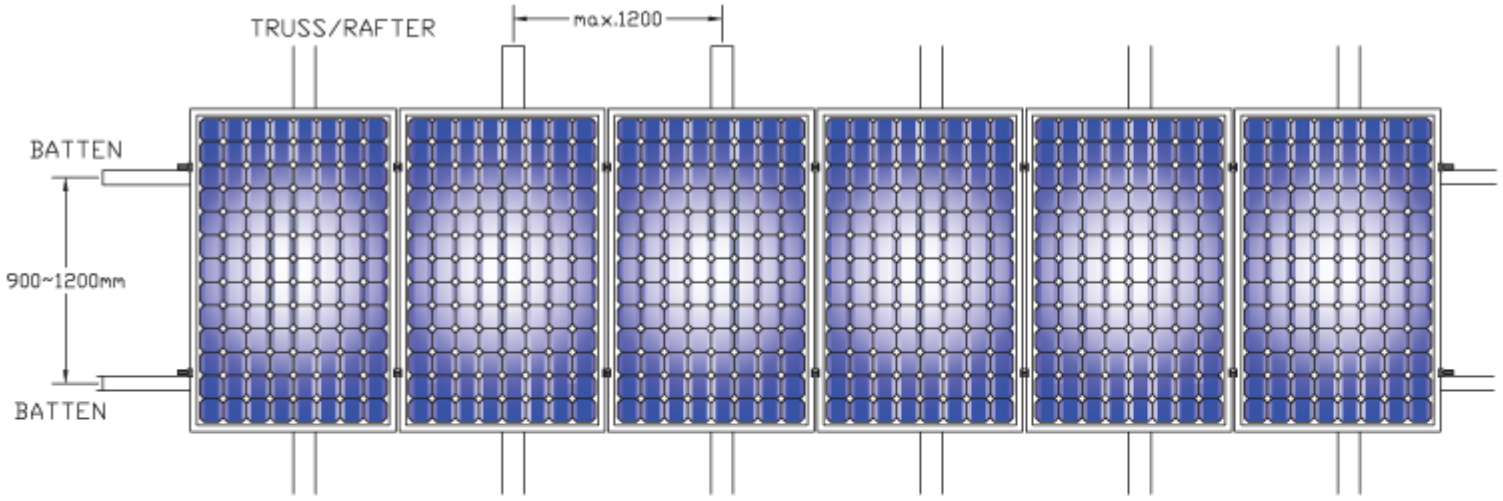
Design Engineer
Name: R.Smaldino
Date: 20/11/2012
Signature:

Certified By:
Craig Shackleford, EC-36632, 6/2/2013

Date of Approval: 11/02/2013

METAL ROOF SYSTEM CONNECTION DETAILS





TYPICAL METAL ROOF SYSTEM HOLD-DOWN LAYOUT

Further Relevant test reports etc;

1.Engineering Calculations are based on Report "S360_EngineeringWorksheet.xls"
2. Tile Mounting system Force Test report:- "TR001_TilePullTest_22Nov12"

10.4 Drawing - Metal Roof Connection Details

Design Engineer
Name: R.Smaldino
Date: 20/11/2012
Signature:

Product Name

360Rack

Product Description

SOLAR PANEL RAIL MOUNTING SYSTEM

Manufacturer's Name

Solar360
A.B.N 99 147 163 488
Lvl 18/499 St. Kilda Rd.
Melbourne VIC 3004
Australia
Phone: 1300 600 360

Design Criteria

BASIC WIND DESIGN CRITERIA
AS 1170.2.2002 (Including Amendment 1)
REGION C - Up TO 10m IN HEIGHT
TERRAIN CATEGORY 2
Shielding Factor (Ms) = No Shielding (Worst case)
Hill Shape Multiplier = 1
Terrain Height Multiple = 1

REGIONAL DESIGN WIND SPEED
Region D - Installation not recommended
Region C w/v = 63m/s, 227 km/hr
Region B w/v = 54m/s, 194 km/hr
Region A w/v = 44m/s, 158 km/hr

Limitations

1. SYSTEM IN ANY CAPACITY IS NOT TO BE INSTALLED IN REGIONS DEFINED AS LOCAL PRESSURE ZONES
2. THIS DESIGN IS FOR SYSTEMS NO GREATER THAN 10m HIGH.
3. LOCATE THIS SYSTEM TOWARDS THE CENTER AREA OF ROOF, WHERE POSSIBLE. PANELS MUST BE AT LEAST 0.5 MTRS AWAY FROM ROOF CREST OR EDGES.
4. ROOF STRUCTURE MUST BE DESIGNED TO ACCEPT THE WEIGHT OF SYSTEM.
5. PITCHED ROOF CALCULATIONS ARE BASED ON ROOF PITCH OF 15 DEGREES OR GREATER. FLAT ROOF CALCULATIONS ARE BASED ON A TILT ANGLE OF UPTO 25 DEGREES (NOT INCLUDING ROOF PITCH)
6. NOT FOR INSTALLATION ON "PRE-CYCLONE" STANDARD BUILDINGS.
7. DESIGN IS ASSIGNED IMPORTANCE LEVEL 2 AS DEFINED IN THE BCA, BUILDING CLASS 1-10 WITH A 25 YEAR DESIGN LIFE. STRUCTURES AT THIS LEVEL ARE EXPECTED NOT TO COLLAPSE BUT MAY SUSTAIN SUBSTANTIAL DAMAGE UNDER THE EXTREME CONDITIONS NOMINATED.
8. INSTALLER TO ASESS WHETHER THE DESIGN IS SUITABLE IN APPLICATIONS THAT ARE NOT COVERED IN THESE DESIGN GUIDELINES. IF NECESSARY INDEPENDENT ENGINEERING ADVICE MAY BE NECESSARY.

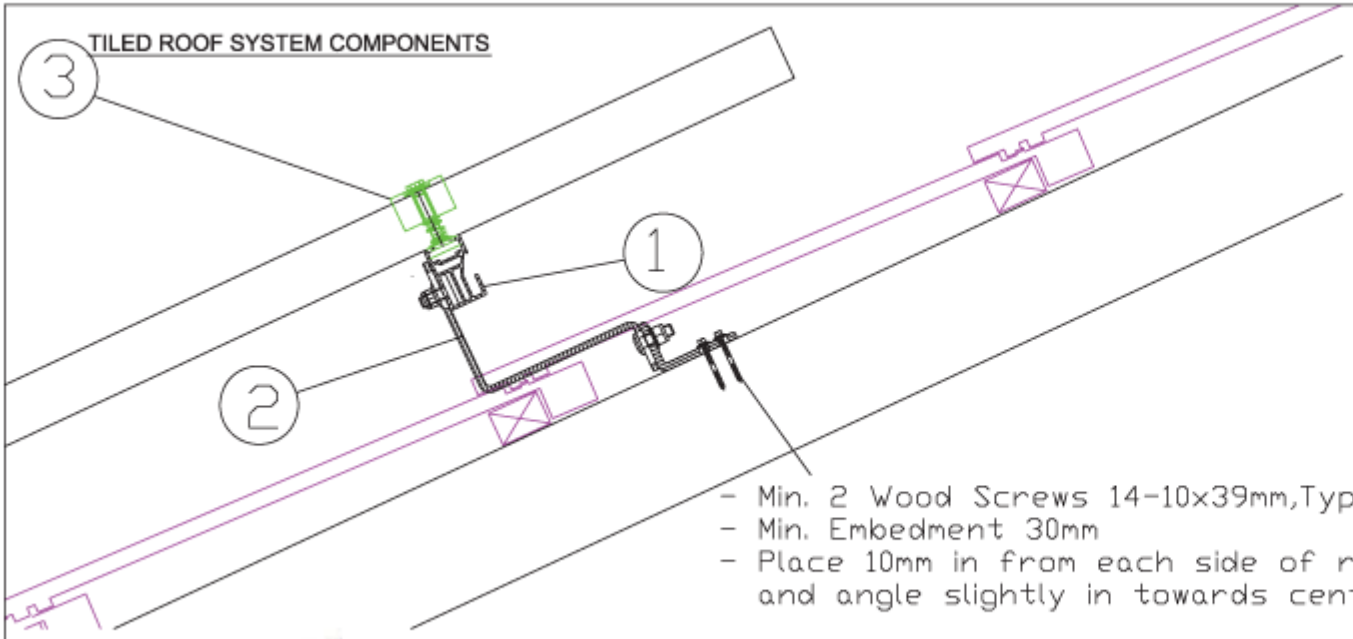
Revision Table

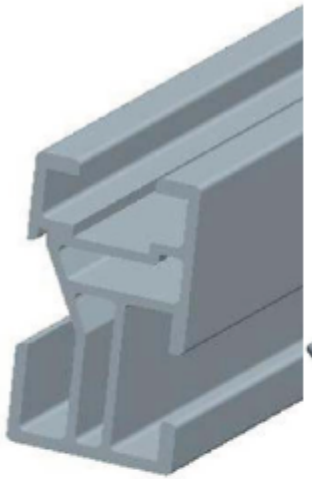
Rev.2 - Certification Amendments, 11/2/2013

Certified By:
Craig Shackleford, EC-36632, 6/2/2013

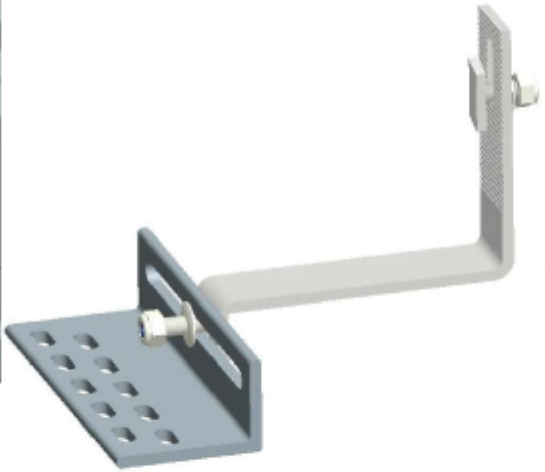
Date of Approval: 11/02/2013

TILED ROOF SYSTEM COMPONENTS

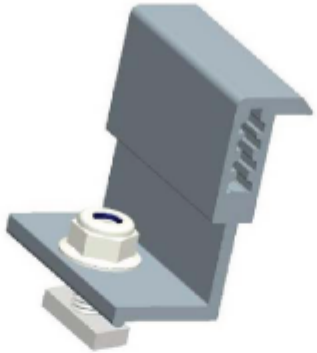

3
1
2
- Min. 2 Wood Screws 14-10x39mm,Type 17
- Min. Embedment 30mm
- Place 10mm in from each side of rafter and angle slightly in towards centre.



1. RAIL SECTION
6063 T5 Aluminum extrusion
2080 & 3380mm Typical



2. Tile Roof Base Plate
6063 T5 Aluminum extrusion



3a. End Clamp
6063 T5 Aluminum extrusion

3b. Mid Clamp
6063 T5 Aluminum extrusion

Further Relevant test reports etc;

1.Engineering Calculations are based on Report "S360_EngineeringWorksheet.xls"
2. Tile Mounting system Force Test report:- "TR001_TilePullTest_22Nov12"

Design Engineer
Name: R.Smaldino
Date: 20/11/2012
Signature:

10.5 Drawing - Tile Roof Components

Product Name

360Rack

Product Description

SOLAR PANEL RAIL MOUNTING SYSTEM

Manufacturer's Name

Solar360
A.B.N 99 147 163 488
Lvl 18/499 St. Kilda Rd.
Melbourne VIC 3004
Australia
Phone: 1300 600 360

Design Criteria

BASIC WIND DESIGN CRITERIA
AS 1170.2.2002 (Including Amendment 1)
REGION C - Up TO 10m IN HEIGHT
TERRAIN CATEGORY 2
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Terrain Height Multiple = 1

REGIONAL DESIGN WIND SPEED
Region D - Installation not recommended
Region C w/v = 63m/s, 227 km/hr
Region B w/v = 54m/s, 194 km/hr
Region A w/v = 44m/s, 158 km/hr

Limitations

1. SYSTEM IN ANY CAPACITY IS NOT TO BE INSTALLED IN REGIONS DEFINED AS LOCAL PRESSURE ZONES
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4. ROOF STRUCTURE MUST BE DESIGNED TO ACCEPT THE WEIGHT OF SYSTEM.
5. PITCHED ROOF CALCULATIONS ARE BASED ON ROOF PITCH OF 15 DEGREES OR GREATER. FLAT ROOF CALCULATIONS ARE BASED ON A TILT ANGLE OF UPTO 25 DEGREES (NOT INCLUDING ROOF PITCH)
6. NOT FOR INSTALLATION ON "PRE-CYCLONE" STANDARD BUILDINGS.
7. DESIGN IS ASSIGNED IMPORTANCE LEVEL 2 AS DEFINED IN THE BCA, BUILDING CLASS 1-10 WITH A 25 YEAR DESIGN LIFE. STRUCTURES AT THIS LEVEL ARE EXPECTED NOT TO COLLAPSE BUT MAY SUSTAIN SUBSTANTIAL DAMAGE UNDER THE EXTREME CONDITIONS NOMINATED.
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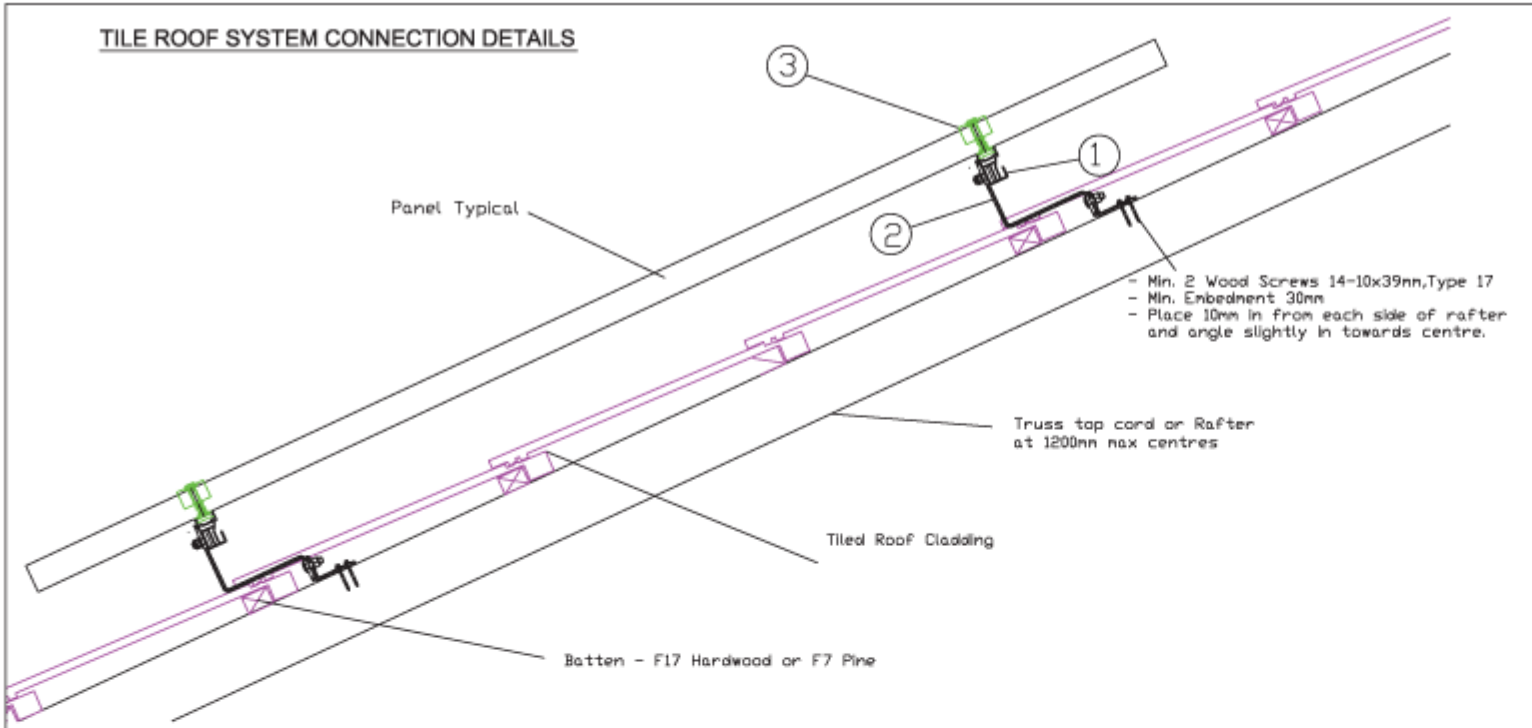
Revision Table

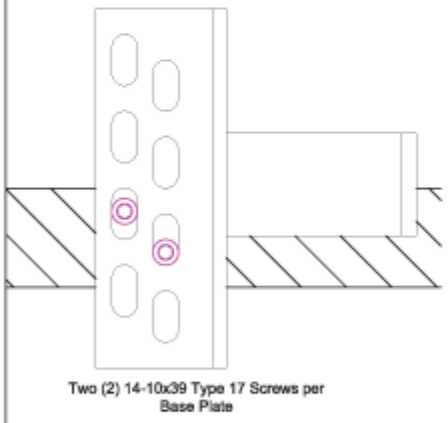
Rev.2 - Certification Amendments, 11/2/2013

Certified By:
Craig Shackleford, EC-36632, 6/2/2013

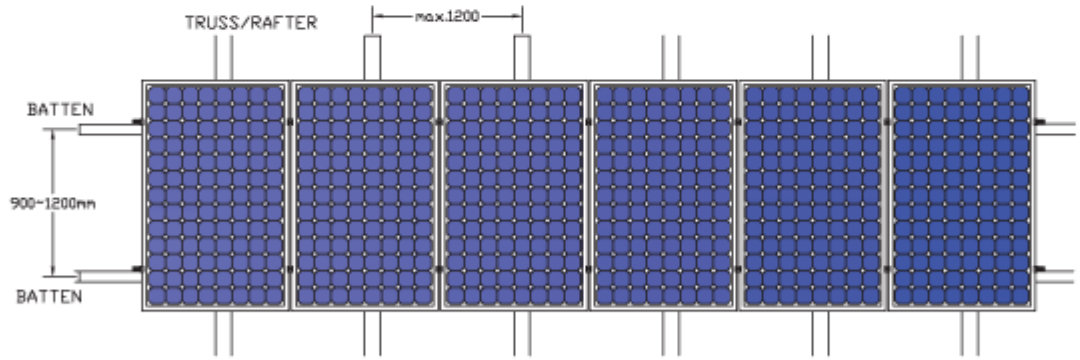
Date of Approval: 11/02/2013

TILE ROOF SYSTEM CONNECTION DETAILS


3
1
2
Panel Typical
- Min. 2 Wood Screws 14-10x39mm,Type 17
- Min. Embedment 30mm
- Place 10mm in from each side of rafter and angle slightly in towards centre.
Truss top cord or Rafter at 1200mm max centres
Tiled Roof Cladding
Batten - F17 Hardwood or F7 Pine



BASE PLATE SCREW LAYOUT



TILED ROOF SYSTEM HOLD-DOWN LAYOUT

Further Relevant test reports etc;

1.Engineering Calculations are based on Report "S360_EngineeringWorksheet.xls"
2. Tile Mounting system Force Test report:- "TR001_TilePullTest_22Nov12"

10.6 Drawing - Tile Roof Connection Details

Design Engineer
Name: R.Smaldno
Date: 20/11/2012
Signature:

Product Name

360Rack

Product Description

SOLAR PANEL RAIL MOUNTING SYSTEM

Manufacturer's Name

Solar360
A.B.N 99 147 163 488
Lvl 18/499 St. Kilda Rd.
Melbourne VIC 3004
Australia
Phone: 1300 600 360

Design Criteria

BASIC WIND DESIGN CRITERIA
AS 1170.2.2002 (Including Amendment 1)
REGION C - Up TO 10m IN HEIGHT
TERRAIN CATEGORY 2
Shielding Factor (Ms) = No Shielding (Worst case)
Hill Shape Multiplier = 1
Terrain Height Multiple = 1

REGIONAL DESIGN WIND SPEED
Region D - Installation not recommended
Region C w/v = 63m/s, 227 km/hr
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Limitations

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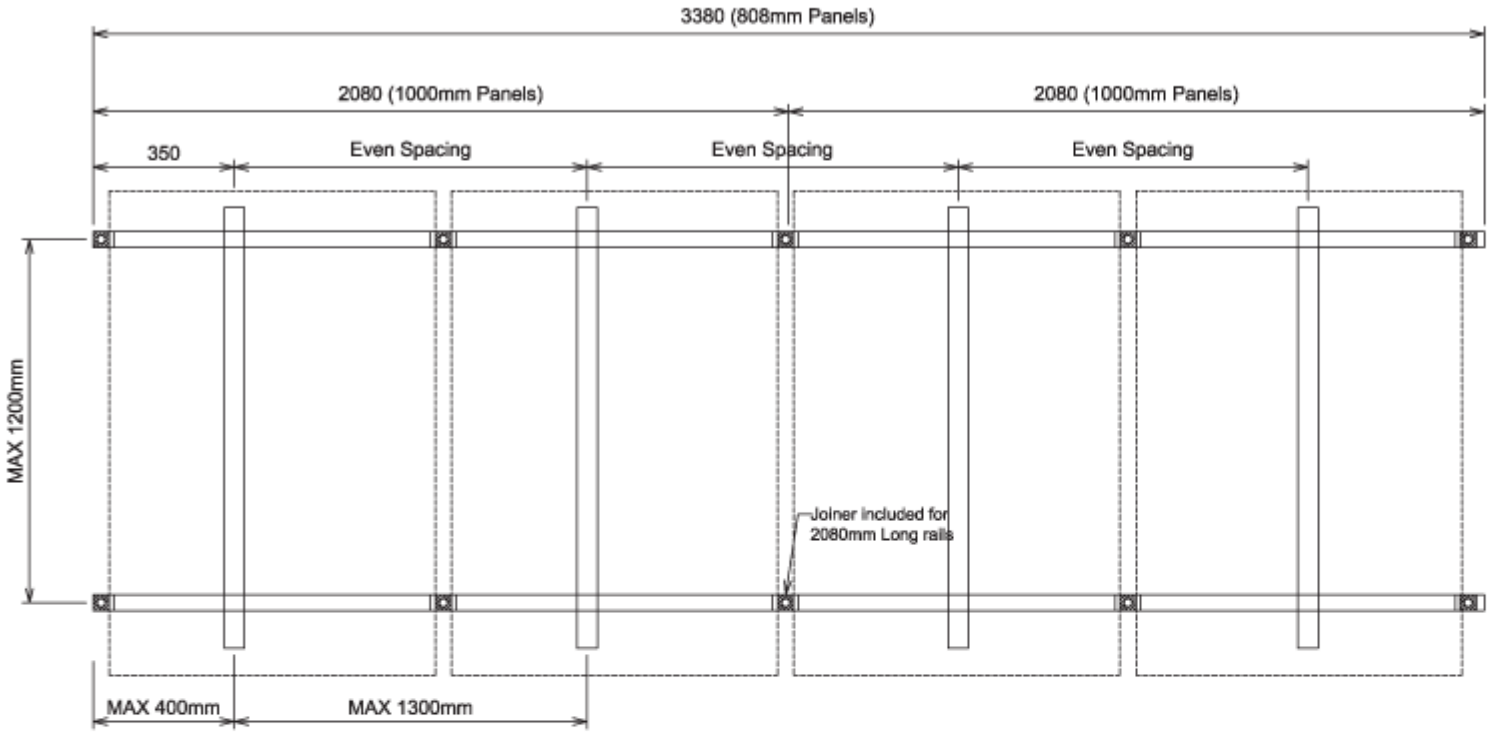
Revision Table

Rev.2 - Certification Amendments, 11/2/2013

Certified By:
Craig Shackleford, EC-36632, 6/2/2013

Date of Approval: 11/02/2013

TYPICAL SYSTEM LAYOUT



- Designs are based on Panel area of 4x1000mm (4160mm Rail Length) Panels, having a surface area of about (4x1.65mtrs= 6.6 sqmtrs) and 4x808mm (3380mm Rail length) Panels (area 5.16 sqmtrs)
- Refer to notes on Pg 8 & 9 or fixings details.
- Each Rail must have a MINIMUM amount of Tilt Assemblies per pair of Rail lengths as per attached table..
- The first & Last bracket must be no further than 400mm from the ends of the rail.
- All effort must be made to space the inner brackets evenly, maximum spaces of 1300mm.
- Rails must not be spaced more than 1200mm apart.
- Various combinations of components may be used, but must not cause any undue stress on the rail, base plates, brackets or the structure being applied.
- End-Clamps & Mid Clamps are to be used to suit panel requirements.
- Joiners can be used to to add more rail lengths as long as the appropriate quantity of mounts are used. Part lengths are also allowed with appropriate scaling (scale up to nearest whole number) of Tilt Assemblies

Minimum No. of Tilt Assemblies required per rail length pair	Region A	Region B	Region C
3380 mm	3	3	4
4160 mm (2x2080mm)	4	4	5

Applicable for Tilt system on metal cladded Roof

1. For fixing to Metal cladded roofs refer to Page 8
2. All bolts and washers are to be Stainless Steel (A2) and all screws are to be Galzanized or a minimum of Class 4 Finish.

Further Relevant test reports etc;

1.Engineering Calculations are based on Report "S360_EngineeringWorksheet.xls"
2. Tile Mounting system Force Test report:- "TR001_TilePullTest_22Nov12"

10.7 Drawing - Tilt System Layout

Design Engineer
Name: R.Smaldino
Date: 20/11/2012
Signature:

Product Name

360Rack

Product Description
SOLAR PANEL RAIL MOUNTING SYSTEM

Manufacturer's Name

Solar360
A.B.N 99 147 163 488
Lvl 18/499 St. Kilda Rd.
Melbourne VIC 3004
Australia
Phone: 1300 600 360

Design Criteria

BASIC WIND DESIGN CRITERIA
AS 1170.2.2002 (Including Amendment 1)
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Hill Shape Multiplier = 1
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REGIONAL DESIGN WIND SPEED
Region D - Installation not recommended
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Region B w/v = 54m/s, 194 km/hr
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Limitations

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5. PITCHED ROOF CALCULATIONS ARE BASED ON ROOF PITCH OF 15 DEGREES OR GREATER. FLAT ROOF CALCULATIONS ARE BASED ON A TILT ANGLE OF UPTO 25 DEGREES (NOT INCLUDING ROOF PITCH)
6. NOT FOR INSTALLATION ON "PRE-CYCLONE" STANDARD BUILDINGS.
7. DESIGN IS ASSIGNED IMPORTANCE LEVEL 2 AS DEFINED IN THE BCA, BUILDING CLASS 1-10 WITH A 25 YEAR DESIGN LIFE. STRUCTURES AT THIS LEVEL ARE EXPECTED NOT TO COLLAPSE BUT MAY SUSTAIN SUBSTANTIAL DAMAGE UNDER THE EXTREME CONDITIONS NOMINATED.
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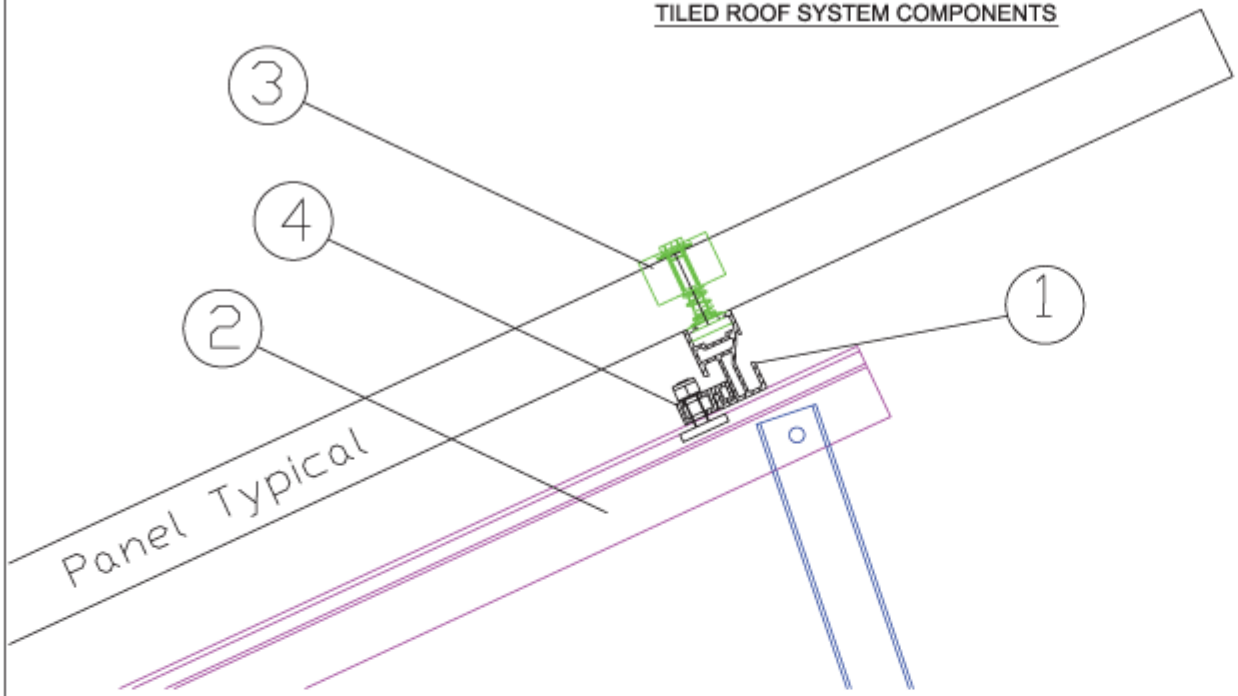
Revision Table

Rev.2 - Certification Amendments, 11/2/2013

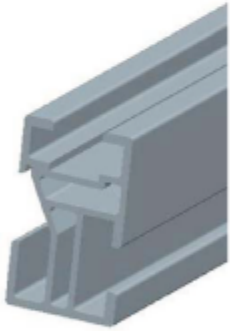
Certified By:
Craig Shackleford, EC-36632, 6/2/2013

Date of Approval: 11/02/2013

TILED ROOF SYSTEM COMPONENTS



4. RAIL CLAMP
6063 T5 Aluminum extrusion



1. RAIL SECTION
6063 T5 Aluminum extrusion
2080 & 3380mm Typical

2. TILT ASSEMBLY
6063 T5 Aluminum extrusion

3a. END CLAMP
6063 T5 Aluminum extrusion

3b. MID CLAMP
6063 T5 Aluminum extrusion

Further Relevant test reports etc;

1.Engineering Calculations are based on Report "S360_EngineeringWorksheet.xls"
2. Tile Mounting system Force Test report:- "TR001_TilePullTest_22Nov12"

10.8 Drawing - Tile Roof Components

Design Engineer
Name: R.Smaldino
Date: 20/11/2012
Signature:

Product Name

360Rack

Product Description
SOLAR PANEL RAIL MOUNTING SYSTEM

Manufacturer's Name

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A.B.N 99 147 163 488
Lvl 18/499 St. Kilda Rd.
Melbourne VIC 3004
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Phone: 1300 600 360

Design Criteria

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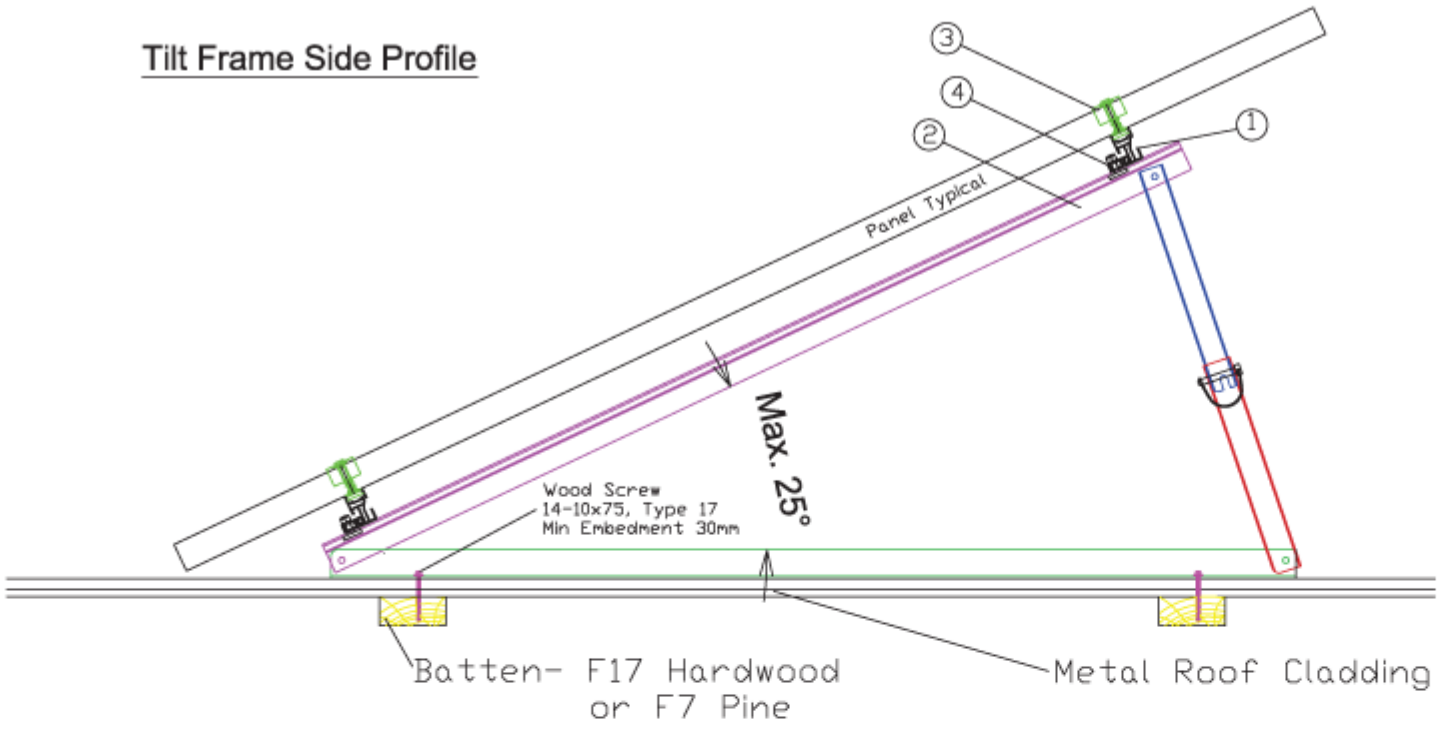
Revision Table

Rev.2 - Certification Amendments, 11/2/2013

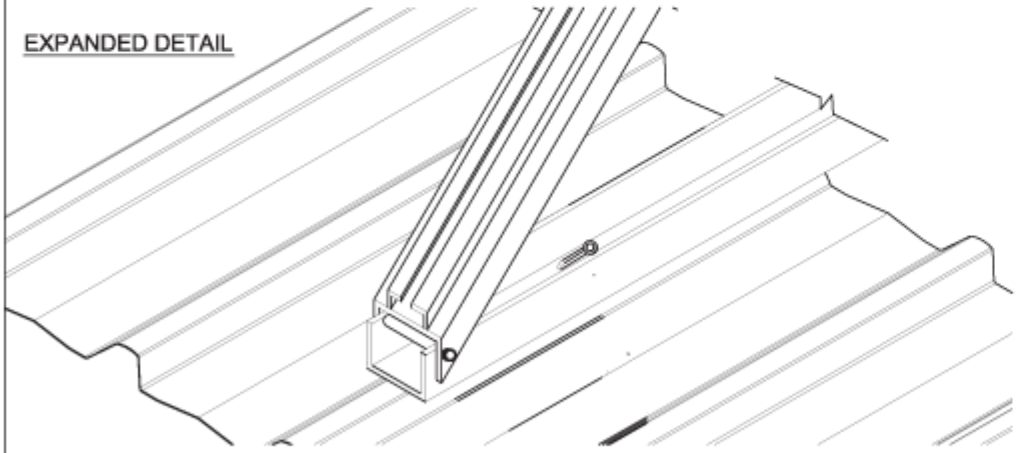
Certified By:
Craig Shackleford, EC-36632, 6/2/2013

Date of Approval: 11/02/2013

Tilt Frame Side Profile



EXPANDED DETAIL



Screw Fixings Notes:

1. BASE PLATE ALLOWS FOR MOUNTING BETWEEN BATON PITCHES OF 800-1200MM. IF PITCH IS 600MM THEN A FURTHER SCREW CAN BE UTILISED AT THE CENTER OF THE BASE PLATE.
2. SCREWS ARE EITHER 14-10X 75MM FOR TIMBER FIXING OR M6 ROOF ZIPS FOR METAL BATONS.
3. IF METAL BATONS HAVE A WALL THICKNESS OF LESS THAN 0.75MM THEN TWO FIXINGS PER BATON SHOULD BE USED TO ENSURE COMPLIANCE.

Product Name

360Rack

Product Description

SOLAR PANEL RAIL MOUNTING SYSTEM

Manufacturer's Name

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Revision Table

Rev.2 - Certification Amendments, 11/2/2013

Further Relevant test reports etc;

1.Engineering Calculations are based on Report "S360_EngineeringWorksheet.xls"
2. Tile Mounting system Force Test report:- "TR001_TilePullTest_22Nov12"

10.9 Drawing - Tilt Roof Connection Details

Design Engineer
Name: R.Smaldino
Date:20/11/2012
Signature:

Certified By:
Craig Shackleford, EC-36632, 6/2/2013

Date of Approval: 11/02/2013